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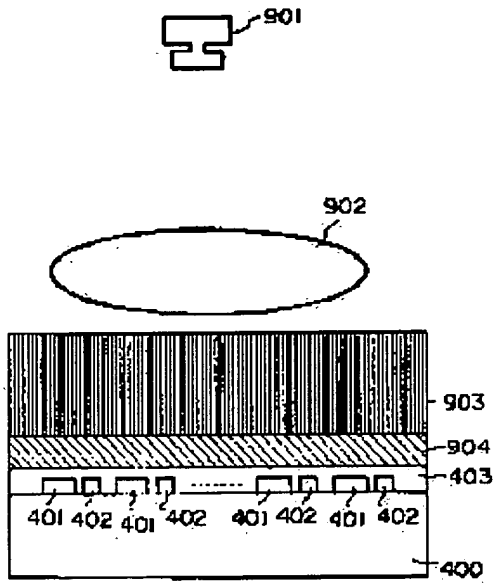
(54) X-RAY PHOTOGRAPHING EQUIPMENT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an X-ray photographing equipment of the next generation having higher efficiency in diagnosis that is not attainable with the conventional film type equipment, having superior space factor that is not attainable with the CCD type, and having higher S/N ratios.
SOLUTION: This X-ray photographic equipment has a two-dimensional image reading apparatus that a plural number of photo-electric converting elements 401 are two-dimensionally arranged on a insulating substrate 400, a fluorescent body 904 that converts the incident X-ray to visible light, and that is formed on the two-dimensional image reading apparatus, and a grid plate 903 that is formed on the fluorescent body and passes only the X-ray coming from a specific direction of the fluorescent body and the two-dimensional image reading apparatus.



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* NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] The two-dimensional picture reader which formed two or more optoelectric transducers in the shape of two-dimensional on the insulating substrate, The fluorescent substance which will be changed into the light if the X-ray formed by sticking substantially on the aforementioned two-dimensional picture reader is irradiated, X-ray image pck-up equipment characterized by having the grid board which was formed between the aforementioned fluorescent substance and X line source, and which derives only the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, and being constituted.
[Claim 2] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y in a certain fixed sensor pitch. the aforementioned grid board The matter which absorbs an X-ray, and the matter which penetrates an X-ray serve as a couple, and in a certain fixed grid pitch, even if there are few Above X or directions of Y, on the other hand, it is arranged in which at **. X-ray image pck-up equipment according to claim 1 characterized by the size of the aforementioned grid pitch direction of the light-receiving side of the aforementioned optoelectric transducer being equal to the pitch of the aforementioned grid board, or being equal N times (N:2 or more positive numbers) of the pitch of the aforementioned grid board.
[Claim 3] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). the aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray become a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- X-ray image pck-up equipment according to claim 1 characterized by being equal N times (N:2 or more positive numbers) of the aforementioned grid pitch or the aforementioned sensor pitch is equal to the aforementioned grid pitch.
[Claim 4] X-ray image pck-up equipment according to claim 3 characterized by providing the physical relationship of the aforementioned two-dimensional picture reader and the aforementioned grid from which the signal output of the aforementioned optoelectric transducer serves as the maximum.
[Claim 5] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, X-ray image pck-up equipment according to claim 1 to 4 characterized by constituting from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] Especially this invention relates to medical-application X-ray-diagnosis equipment about the high X-ray image pck-up equipment of a S/N ratio by the large area.
[0002]
[Description of the Prior Art] Now, with the X-ray image pck-up equipment used for a medical diagnosis, the fluorescent substance made to change into the light the X-ray which was made to carry out exposure of the X-ray to a human body, and penetrated the human body is made to irradiate, and the method which makes a film expose the fluorescence is in use (it is called a film method below).
[0003] Drawing 18 is drawing showing the outline composition of the X-ray-diagnosis equipment by the film method. In drawing 18 , 901 is an X line source to which a patient is made to do exposure of the X-ray, and X-ray intensity and exposure time are adjusted according to the diagnostic purpose. X-rays are scattered about in all the directions within a human body (patient) 902. Then, the making the resolution of an X-ray picture increase purpose, only the X-ray of the specific direction which has used the grid board of 903 is drawn by the fluorescent substance (scintillator) 904.
[0004] In a scintillator 904, the parent matter of a fluorescent substance is excited by the high X-ray of energy (absorption), and the fluorescence of a visible region is acquired by the recombination energy at the time of recombining. the fluorescence -- CaWO4 CdWO4 etc. -- there are some which are depended on the emission center matter activated in parents, such as a thing, CsI:Tl, ZnS:Ag, etc. which are depended on the parent itself Recently, the fluorescent substance which used rare earth elements like Tb, Eu, and Pr for the emission center has also come to be used.
[0005] The matter (for example, lead) which absorbs an X-ray, and the matter (for example, aluminum) which penetrates an X-ray are arranged in by turns, and the grid board has cross-section composition like drawing 2 .
[0006] The fluorescence from a scintillator 904 is exposed by the film of 905, and a patient's X-ray picture is obtained through a development.
[0007] Moreover,-dimensional [1] or a two-dimensional CCD solid state image pickup device is used instead of a film 905, and there is also X-ray image pck-up equipment that carry out image formation of the fluorescence from a scintillator 904, and it carries out photo electric translation with reduction optical system.
[0008]
[Problem(s) to be Solved by the Invention] Also globally, as for Japan which can be going an aging society, improvement in the diagnostic efficiency in a hospital and medical equipment with a more high precision are desired strongly from the first. In the X-ray image pck-up equipment in the conventional film method, it has the trouble described below in such situations.
[0009] Since there will be a development process of a film on the way by the time a doctor gets a patient's X-ray picture, it takes time and effort and time.
[0010] Moreover, when neither the case where the patient has moved into roentgenography as a time, nor exposure suits, redo of photography is obliged again. These are factors which bar the improvement in efficiency of medical examination in a hospital.
[0011] Moreover, in order to obtain the X-ray picture needed for a diagnosis since a clear X-ray picture is not obtained depending on the angle whose picture the affected part which it is going to photo takes, a photography angle may have to be changed and several sheets may have to be photoed. Especially this is not a desirable thing when patients are infants and a gravida.
[0012] Furthermore, it is necessary to carry out period storage, the number of sheets of the film in a hospital serves as a huge amount, and the photoed X-ray picture film is not efficient in respect of management in the hospital which is in a hospital of being as put **** [, and]. [taking out to the degree of a visit to the hospital of a patient] Moreover, when the case where the patient who is present in a remote place needs to receive a diagnosis of the university hospital average in center of Tokyo, and a patient remove to overseas, and when [other] a hospital must be changed by a certain reason, you have to send the X-ray film photoed until now to the next hospital by a certain method. Otherwise, you have to retake a photograph again in the hospital which newly goes to hospital regularly.
[0013] These things serve as a serious obstacle, when aiming at future new medical society. In this invention, it sets it as the 1st purpose to solve the technical problem explained above.

[0014] In the medical industry, the demand of "digitization of X-ray picture information" is increasing in recent years. If X-ray picture information can be managed using a record medium like a magneto-optic disk if digitization is attained, a doctor can acquire the X-ray picture information of the patient in the optimal angle for real time and facsimile, other communication modes, etc. are used, a patient's X-ray picture information will become possible [sending even to a hospital of what among the world for a short time]. Furthermore, if the acquired digital X-ray picture information performs an image processing using a computer, a diagnosis in a still higher precision will be attained compared with the former, and all the above-mentioned technical problems in the conventional film method will be solved.
[0015] Recently, the X-ray image pck-up equipment of "digitization of X-ray picture information" which used the CCD solid state image pickup device instead of the film to reply to a demand is also considered.
[0016] However, for the moment, a CCD solid state image pickup device is unproducible by the comparable size in the size of a human body. When using a CCD solid state image pickup device, it is necessary to make a CCD light-receiving side carry out image formation of the fluorescence, i.e., X-ray image, from a scintillator with reduction optical system. The problem that it is difficult to make reduction optical system containing a lens small, and X-ray image pck-up equipment is enlarged arises.
[0017] Moreover, in order to carry out image formation through a lens, the light which does not carry out incidence to a lens becomes useless. Therefore, although it is dependent also on reduction percentage, the light included in a lens decreases to 1 / 100 - 1/1000, it is said that 2 figures - 3 figures of S/N (signal) ratios are generally downed [before letting a lens pass], and a bird clapper is expected to be disadvantageous when using for the medical equipment with which high gradation nature is demanded.
[0018] [Objects of the Invention] -- as stated above, by this invention, it aims at offer of the X-ray image pck-up equipment of the next generation which is excellent in a space factor and can take a high S/N ratio which can aim at the efficiency rise of the medical examination which is not obtained, and is not in a CCD method by the conventional film method
[0019]
[Means for Solving the Problem] this invention offers the following meanses in order to solve the technical problem mentioned above.
[0020] [1] The two-dimensional picture reader which formed two or more optoelectric transducers in the shape of two-dimensional on the insulating substrate, The fluorescent substance which will be changed into the light if the X-ray formed by sticking substantially on the aforementioned two-dimensional picture reader is irradiated, X-ray image pck-up equipment characterized by having the grid board which was formed between the aforementioned fluorescent substance and X line source, and which derives only the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, and being constituted.
[0021] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). [2] The aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray serve as a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- the above -- an optoelectric transducer -- light-receiving -- a field -- the above -- a grid -- a pitch -- a direction -- a size -- the above -- a grid -- a board -- a pitch -- being equal -- or -- or -- the above -- a grid -- a board -- a pitch -- N -- a time (N:2 or more positive numbers) -- being equal -- things -- the feature -- ** -- carrying out -- [-- one --] -- a publication -- an X-ray -- an image pck-up --
[0022] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). [3] The aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray become a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- the above -- a sensor -- a pitch -- the above -- a grid -- a pitch -- being equal -- or -- the above -- a grid -- a pitch -- N -- a time (N:2 or more positive numbers) -- being equal -- things -- the feature -- ** -- carrying out -- [-- one --] -- a publication -- an X-ray -- an image pck-up -- equipment .
[0023] [4] X-ray image pck-up equipment given in [3] characterized by providing the physical relationship of the aforementioned two-dimensional picture reader and the aforementioned grid from which the signal output of the aforementioned optoelectric transducer serves as the maximum.
[0024] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side [5] The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, X-ray image pck-up equipment given in either of [1] - [4] characterized by constituting from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer.
[0025]
[Embodiments of the Invention]
The two-dimensional picture reader which the X-ray image pck-up equipment concerning a [operation] this invention made form two or more optoelectric transducers in the shape of two-dimensional on an insulating substrate, Between the fluorescent substance which will be changed into the light if the X-ray stuck on the aforementioned two-dimensional picture reader is

irradiated, and the aforementioned fluorescent substance and X line source By constituting from a grid board formed in order to derive only the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, without using a film, an X-ray picture can be obtained and data processing also becomes easy.

[0026] Moreover, since the reduction optical system containing a lens is unnecessary, the operation which can miniaturize the whole X-ray image pck-up equipment is obtained.

[0027] Furthermore, since the light from a fluorescent substance can use almost, the high X-ray image pck-up equipment of a S/N ratio can be offered.

[0028] even if to say nothing of the efficiency of a large medical examination rising in a hospital by this construction of the diagnostic-information network in the whole country is attained and it is in a remote place, the medical treatment of a hospital in the center of Tokyo can receive -- like -- the diagnostic efficiency in the whole medical community is gathered

[0029] Moreover, since the grid is prepared, operation of removing the scattered X-rays in the inside of the body is obtained.

[0030] Moreover, it sets to the two-dimensional picture reader which constitutes the X-ray image pck-up equipment of this invention. One optoelectric transducer used as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). the aforementioned grid board It is arranged in the one direction and sets to the aforementioned optoelectric transducer. the matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray -- a couple -- becoming -- a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- When the pitch of a grid board is equal N times (N:2 or more positive numbers) and the size of the direction of a grid pitch of the light-receiving side makes it equal to the pitch of a grid board, moire does not occur but offer of the reliable X-ray image pck-up equipment of high resolution is attained.

[0031] Moreover, the two-dimensional picture reader which constitutes another X-ray image pck-up equipment of this invention One optoelectric transducer used as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). the aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray serve as a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- When it is equal to a grid pitch, or a grid pitch is equal N times (N:2 or more positive numbers) and the aforementioned sensor pitch carries out, there is an operation which prevents generating of moire. Furthermore, by providing the physical relationship of the aforementioned two-dimensional picture reader and the aforementioned grid from which the signal output of the aforementioned optoelectric transducer serves as the maximum, there is operation that the S/N ratio as X-ray image pck-up equipment becomes large.

[0032] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, If constituted from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer Thin film production equipments, such as the existing CVD system and a sputtering system, can be used easily, the image pck-up portion of X-ray image pck-up equipment is made to a large area, and there is operation that moreover it is cheaply producible. And it is thinly small by constituting using the grid of the aforementioned photoelectrical inverter section and the same size, and an X-ray visible conversion fluorescent substance, and the high X-ray image pck-up equipment of an S/N can offer, and since the X-ray picture data obtained by that cause can use together with digital technology easily, the operation effect which raises the diagnostic efficiency of the future whole medical community sharply brings about. Hereafter, the operation form of this invention is explained in detail based on a drawing.

[0033] [Operation form 1] drawing 1 is the whole X-ray image pck-up equipment block diagram showing the 1st operation form of this invention. In drawing 1 , the X-ray from the X line source 901 is irradiated by the human body 902, absorption, transparency, and dispersion take place within a human body according to in-the-living-body matter, such as lungs, a bone, a blood vessel, or the focus, and the X-ray which has passed through the inside of a human body goes in the direction of a grid 903.

[0034] Drawing 2 and drawing 3 are drawings showing the cross-section composition of a grid, and the matter 200 (for example, lead) with which a grid absorbs an X-ray, and the matter 201 (for example, aluminum) which penetrates an X-ray are arranged by turns. It is in preventing the fall of the resolution by the X-ray scattered about in the body as a reason for preparing a grid. That is, the X-ray which only the X-ray of the specific direction (the direction of a cross section of a grid) passed the radioparency matter 201, reached the scintillator (fluorescent substance) 904, and were scattered about in the body is absorbed by the absorber 200 of a grid, and cannot reach a scintillator.

[0035] The X-ray irradiated by the scintillator 904 is excited with a fluorescent substance within a scintillator (absorption), and the fluorescence near the spectral sensitivity wavelength field of an optoelectric transducer 401 is emitted from a scintillator.

[0036] A fluorescent substance and the stuck optoelectric transducer 401 carry out photo electric translation of the fluorescence to which the X-ray image from a scintillator 904 corresponds, and although not illustrated by drawing 1 with a switching element 402, a signal charge is transmitted to processing circuits (AMP, A-D converter, etc.).

[0037] What is necessary is here, to have not stuck the fluorescent substance completely with an optoelectric transducer, and

just to have stuck it substantially. "Substantial adhesion" is arranging a fluorescent substance at an interval small enough to a sensor pitch. If it does in this way, light cannot fully be used and a picture will not necessarily fade.
[0038] In order that an optoelectric transducer 401 and a switching element 402 may be made on an insulating substrate 400 and may protect an element on 401,402, they are covered by the protective coat 403.
[0039] Drawing 2 and drawing 3 are drawings having shown the cross section of the grid which consists of drawing 1 . In drawing 2 , it is the grid used when X line source is installed comparatively far away, and the X-ray absorption matter (Pb) and the radioparency matter (aluminum) are the types arranged in parallel. On the other hand, in the cross-section composition, the grid shown in drawing 3 has the structure where the X-ray absorption matter (Pb) and the radioparency matter (aluminum) were turned in the direction of the X line source 901, when the distance of X line source and a grid is in comparatively near physical relationship, it is used, and it has an advantage in space as an X-ray image pck-up device. Moreover, since the X-ray which was passed directly in the case of the grid of drawing 3 , without being absorbed and scattered about in a body is directly irradiated by the scintillator as it is, brighter fluorescence is acquired and a S/N ratio becomes advantageous.
[0040] Drawing 4 is a plan showing the two-dimensional optoelectric transducer and two-dimensional switching element of a photoelectrical inverter portion for 4 pixels in the X-ray image pck-up equipment of this invention. The hatching section 405 in drawing is a light-receiving side which receives the fluorescence from a scintillator. 402 is a switching element which transmits the signal charge by which photo electric translation was carried out by the optoelectric transducer 401 to a processing circuit side, and the control line by which 408 controls the switching element, and 409 are signal lines connected in a processing circuit. 410 is a power supply line which gives bias to an optoelectric transducer. Moreover, 420 is a contact hole for connecting an optoelectric transducer 401 and a switching element 402.
[0041] Drawing 5 is the cross section cut by A-B in drawing 4 . Here explains the formation method of the photoelectrical inverter section in this invention.
[0042] First, on an insulating substrate 400, by the spatter or the resistance heating method, the about 500A vacuum evaporationo of the 1st metal thin film layer 421 is carried out, patterning of the chromium (Cr) is carried out by photo lithography, and unnecessary area is **********ed. This 1st metal thin film layer 421 serves as a lower electrode of an optoelectric transducer 401, and a gate electrode of a switching element 402.
[0043] next, CVD -- the inside of the same vacuum -- a-SiNx (425), a-Si:H (426), and N+ layer (427) -- respectively -- 2000 -- the laminating of every 5000 or 500A is carried out one by one These each class is the insulating layer / photo-electric-translation semiconductor layer / hole pouring blocking layer of an optoelectric transducer 401, and turns into a gate insulator layer / semiconductor layer / ohmic-contact layer of a switching element 402 (TFT). Moreover, it is used also as an insulating layer of the cross section (430 of drawing 4) of the 1st metal thin film layer 421 and the 2nd metal thin film layer 422. The thickness of each class is designed by not only the above-mentioned thickness but the voltage used as a photoelectrical inverter, a charge, the amount of incidence fluorescence from a scintillator, etc. the optimal. At least, it is a-SiNx. 500A or more which cannot pass through electron and a hole and can function enough as a gate insulator layer of TFT is desirable.
[0044] After depositing each class, dry etching of the area used as a contact hole (420 references of drawing 4) is carried out by RIE or CDE, and about 10000A (aluminum) of aluminum is made to deposit in a spatter or a resistance heating method as 2nd metal thin film layer 422 after that. Furthermore, patterning is carried out by photo lithography, and unnecessary area is **********ed.
[0045] The 2nd metal thin film layer serves as wiring of the up electrode of an optoelectric transducer 401, the source of Switching TFT, a drain electrode, and others etc. Moreover, an up-and-down metal thin film layer is connected in the contact hole section simultaneously with membrane formation of the 2nd metal thin film layer 422.
[0046] Furthermore, in order to form the channel section of TFT, it **********s by the RIE method in a source electrode and drain inter-electrode [a part of], and it is unnecessary a-SiNx after that. A layer, an a-Si:H layer, and N+ layer are **********ed by the RIE method, and each element is separated. Now, an optoelectric transducer 401, switching TFT 402, other wiring (408,409,410), and the contact hole section 420 are formed.
[0047] Although only 2 pixels is not illustrated in the cross section of drawing 5 , it cannot be overemphasized that many pixels are simultaneously formed on an insulating substrate 400. To the last, it is SiNX in each element and wiring as a purpose on a moisture-proof disposition. It covers with the passivation film (protective coat) 403.
[0048] An optoelectric transducer, Switching TFT, and wiring are formed only by etching of the 1st common metal thin film layer and a-SiNx which were deposited simultaneously, a-Si:H, N+ layer and the 2nd metal thin film layer, and each class as the above explanation. Moreover, a pouring blocking layer has only one place into an optoelectric transducer, and it is formed within the same vacuum layer.
[0049] Here, device operation of optoelectric-transducer 401 simple substance currently used with this operation gestalt is explained.
[0050] Drawing 6 (a) and (b) are the energy-band views of an optoelectric transducer showing operation of the refreshment mode of this operation gestalt, and a photoelectrical translation mode, respectively, and express the state of the thickness direction of each class of drawing 5 . 602 is the lower electrode (it is described as G electrode below) formed by Cr. 607 is the insulating layer formed by SiN from which an electron and a hole prevent passage, and the thickness is set as 500A or more which is thickness to the extent that an electron and a hole are unmovable with the tunnel effect. The

photo-electric-translation semiconductor layer in which 604 was formed by i layers of intrinsic semiconductors of hydrogenation amorphous silicon a-Si, the pouring blocking layer of n layers of a-Si from which 605 prevents pouring of the hole to the photo-electric-translation semiconductor layer 604, and 606 are up electrodes (it is described as D electrode below) formed with aluminum.

[0051] Although D electrode has not covered n layers completely with this operation gestalt, since, as for for D electrode and n layers, an electron transfer is performed freely, D electrode and the potential of n layers are always these potentials, and are premised on it by explanation below. This optoelectric transducer has two kinds of operation called refreshment mode and a photoelectrical translation mode by the method of impression of the voltage of D electrode and G electrode.

[0052] In drawing 6 (a) in refreshment mode, the hole where the electronegative potential is given to G electrode, and D electrode was shown by the black dot in i layer 604 is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 604. n-layer 605 or i layers, at this time, in 604, some of holes and electrons are recombined and disappear. If this state continues time long enough, the hole in i layer 604 will be swept out from 604 i layers.

[0053] From this state, for making it drawing 6 (b) of a photoelectrical translation mode, an electropositive potential is given to D electrode to G electrode. Then, the electron in i layer 604 is led to D electrode in an instant. However, a hole is not led to 604 i layers, in order that 605 [n-layer] may work as a pouring blocking layer. If light carries out incidence into i layer 604 in this state, light will be absorbed and an electron and a hole pair will generate it. This electron is led to D electrode by electric field, and a hole moves in the inside of i layer 604, and gives i layers to the interface of 604 and an insulating layer 607. However, since it cannot move into an insulating layer 607, it will stop in i layer 604. In order for an electron to move to D electrode at this time, and to move a hole to insulating-layer 607 interface in i layer 604, and to maintain the electrical neutrality in an element, current flows [current] from G electrode. Since this current corresponds to the electron and hole pair generated by light, it is proportional to the light which carried out incidence. If it will be in the state of drawing 6 (a) in refreshment mode again after maintaining drawing 6 (b) of a certain period photoelectrical translation mode, the hole which had stopped at 604 i layers will be led to D electrode as mentioned above, and the current corresponding to this hole will flow simultaneously. The amount of this hole corresponds to the total amount of the light which carried out incidence to the photoelectrical translation-mode period. What is necessary is to carry out the fixed hatchet difference of this amount about, to subtract it, and just to detect it, although the current corresponding to the amount of the electron poured in into i layer 604 at this time also flows. That is, while the optoelectric transducer in this operation gestalt outputs the amount of the light which carries out incidence to real time, it can also output the total amount of the light which carried out incidence to a certain period.

[0054] However, although the period of a photoelectrical translation mode becomes long for a certain reason, or incidence is in light when the illuminance of the light which carries out incidence is strong, current may not flow. This is because many holes stop in i layer 604, the electric field in i layer 604 become small like drawing 6 (c) since it is this hole, and the generated electron is no longer led to D electrode and recombines with the hole in i layer 604. Although current may flow unstably when the state of the incidence of light changes in this state, if it is again made refreshment mode, the current which the hole in i layer 604 was swept out and is proportional to light again in the following photoelectrical translation mode will be acquired.

[0055] Moreover, in the above-mentioned explanation, although an ideal sweeps out all holes when sweeping out the hole in i layer 604 in refreshment mode, it is also effective to sweep out some holes, current equal to the above-mentioned is acquired, and it is satisfactory. That is, what is necessary is for it to be good if it is not in the state of (c) of drawing 6 in the detection opportunity in the following photoelectrical translation mode, and just to decide the property of the period in potential and refreshment mode and the pouring blocking layer of n layer 605 to G electrode of D electrode in refreshment mode. Furthermore, in refreshment mode, i layers of pourings of the electron of 604 are not a requirement, and the potential to G electrode of D electrode is not limited to negative, either. When i layers of many holes have stopped at 604, even if it compares and the potential to G electrode of D electrode is an electropositive potential, the electric field in i layers are because it is added in the direction which leads a hole to D electrode. It is not a requirement that the property of the pouring blocking layer of 605 can pour similarly n layers of i layers of electrons into 604.

[0056] Next, photo-electric-translation operation at the time of extending concretely the optoelectric transducer shown by drawing 7 to two-dimensional, and constituting it is explained. Drawing 9 is a representative circuit schematic showing the photoelectrical inverter arranged to two-dimensional, and drawing 10 is a timing chart which shows the operation.

[0057] S11-S33 show the lower electrode side by the optoelectric transducer, and show the G and up electrode side by D in drawing 9 . T11-T33 are Switching TFT. Vs is a power supply for read-out, Vr is a power supply for refreshment, and it connects with D electrode of all the optoelectric transducers S11-S33 through Switches SWs and SWr, respectively. Switch SWr is directly connected to the refreshment control circuit RF through the inverter, and Switch SWs is controlled so that SWr turns on a refreshment period and SWs turns on the period of on and others. 1 pixel consists of one optoelectric transducer and switching TFT, and the signal output is connected to the integrated circuit IC for detection by signal wiring SIG. A photoelectrical inverter here divides a total of nine pixels into three blocks, transmits a 3 pixels [per block] output simultaneously, through this signal wiring SIG, is changed one by one into an output by the integrated circuit IC for detection, and is outputted (Vout). Moreover, each pixel is arranged in two dimensions by arranging 3 pixels in 1 block in a longitudinal direction, and arranging 3 blocks perpendicularly in order.

[0058] Next, operation of 1 pixel of photoelectrical transducers in the X-ray image pck-up equipment in this operation gestalt

is explained using drawing 7 and drawing 8 . Drawing 7 is an equal circuit including the optoelectric transducer for 1 pixel, and Switching TFT, and drawing 8 is a timing chart which shows the operation. First, since an optoelectric transducer 401 is refreshed, where bias power supply 701 is made into a certain voltage value (Vr), Gate Vg (730) and the switching element 705 for reset of switching TFT 402 are turned on. By this, D electrode of an optoelectric transducer 401 is refreshed in Vr, G electrode is refreshed on the bias VBT of the power supply 707 for reset (Vr<VBT), and an optoelectric transducer will be in an accumulation state (readout mode) after this operation. Then, the X line source 901 is turned on, the X-ray which passed the human body and the grid 903 is irradiated by the scintillator 904, and ****** photo electric translation of the fluorescence is carried out to an optoelectric transducer 401. a-SiNx which constitutes an optoelectric transducer Since an insulating layer and an a-Si:H photo-electric-translation semiconductor layer are also dielectrics, an optoelectric transducer functions also as capacitative element. That is, the signal charge by which photo electric translation was carried out by the optoelectric transducer is accumulated in an optoelectric transducer. Then, Vg of TFT is made to turn on and the signal charge in an optoelectric transducer is transmitted to capacitative element 713. Especially the capacitative element 713 is not necessarily formed as a drawing 4 top element, and is inevitably formed in the cross section 430 grade of a vertical inter-electrode capacity of TFT, a signal line 409, and the gate line 408. Of course, according to a design, you may make separately as an element. The above operation is performed by the amorphous device formed on the insulating substrate except for the gate control of current supply or TFT. Then, the signal charge of capacitative element 713 is transmitted to capacity 720 by the switching element 725 in a processing circuit, and a signal is outputted by the operational amplifier 721. Then, capacity 720 is reset by the switch 722, capacitative element 713 is reset by the switch 705, and operation for 1 pixel is completed.

[0059] Next, operation of the X-ray image pck-up equipment portion of this operation gestalt is explained using drawing 9 and drawing 10 .

[0060] The control wiring g1-g3 is first impressed by shift registers SR1 and SR2, and Hi is impressed to s1-s2. then, the object for a transfer -- switching TFT-T11-T33 and switches M1-M3 flow, and G electrode of all the optoelectric transducers S11-S33 becomes GND potential (since the input terminal of the integral-detection machine Amp is designed by GND potential) The refreshment control circuit RF outputs Hi simultaneously, Switch SWr turns on, and D electrode of all the optoelectric transducers S11-S33 becomes right potential by the power supply Vr for refreshment. Then, all the optoelectric transducers S11-S33 become refreshment mode, and are refreshed. Next the refreshment control circuit RF outputs Lo, Switch SWs turns on, and D electrode of all the optoelectric transducers S11-S33 becomes right potential by the power supply Vs for reading. Then, all the optoelectric transducers S11-S33 become a photoelectrical translation mode. Lo is impressed to the control wiring g1-g3, and s1-s2 by shift registers SR1 and SR2 in this state. then, the object for a transfer -- the switches M1-M3 of switching TFT-T11-T33 turn off, and although G electrode of all the optoelectric transducers S11-S33 becomes open in DC, since each optoelectric transducer is also a capacitor, potential is held However, at this time, since incidence of the X-ray is not carried out, incidence of the light is not carried out to all the optoelectric transducers S11-S33, and a photocurrent does not flow. Outgoing radiation of the X-ray is carried out in pulse in this state, a human body, a scintillator, etc. are passed and the fluorescence from a scintillator carries out incidence to each optoelectric transducer S11-S33. As for this light, the information on internal structures, such as a human body, is included. The photocurrent which flowed by this light is accumulated in each optoelectric transducer as a charge, and after the incidence end of an X-ray is held. next, a control pulse is impressed by the control wiring g1 with a shift register SR 1 at Hi -- having -- the control pulse impression to the control wiring s1-s3 of a shift register SR 2 -- the object for a transfer -- v1-v3 are outputted one by one through TFT-T11-T13 and switches M1-M3 Other lightwave signals are similarly outputted one by one by control of shift registers SR1 and SR2. Thereby, the 2-dimensional information on internal structures, such as a human body, is acquired as v1-v9. Although it is the operation so far when obtaining a static image, when obtaining a dynamic image, the operation so far is repeated.

[0061] Since it connects in common and D electrode of an optoelectric transducer is controlling this common wiring by this operation gestalt through Switch SWr and Switch SWs to the potential of the power supply Vr for refreshment, and the power supply Vs for reading, all optoelectric transducers can be simultaneously switched to refreshment mode and a photoelectrical translation mode. For this reason, complicated control can be made for there to be nothing and an optical output can be obtained by one TFT per pixel.

[0062] In drawing 9 , nine 2-dimensional pixels are arranged to 3x3, and simultaneously, 3 pixels of 40cmx40cm X-ray detectors will be obtained at a time, if not only this but 5x5 pixels per 1mm of every direction are arranged in two dimensions as 2000x2000 pixels, although it divided into 3 times and the transfer and the output of were done. If this is combined with an X-ray generator instead of an X-ray film and X-ray roentgen equipment is constituted, it can be used for a thorax roentgen medical checkup or a breast cancer medical checkup. By doing so, it is possible to project the output by CRT in an instant unlike a film, and it is also possible to change an output into digital one further and to change into the output which carried out the image processing by computer and which was doubled with the purpose. Moreover, storage is also possible for a magneto-optic disk, and the past picture can also be searched in an instant. Moreover, sensitivity can also acquire a clear picture through a feeble X-ray with little [it is better than a film and] influence on a human body.

[0063] The conceptual diagram showing mounting of the detector which has 2000x2000 pixels in drawing 11 and drawing 12 is shown. In the element in the dashed line shown by drawing 9 , when it constitutes 2000x2000 detectors, although what is necessary is just to increase a number in all directions, it becomes 2000 to the control wiring g1-g2000 in this case, and signal wiring SIG is also set to sig1-sig2000 to 2000. Moreover, a shift register SR 1 and the integrated circuit IC for detection must

carry out control and processing of 2000, and become large-scale. One chip becomes very large and it is disadvantageous at a yield, a price, etc. at the time of manufacture to perform this with the element of one chip, respectively. Then, a shift register SR 1 is formed in every 100-step one chip, and should just use 20 pieces (SR 1-1 - SR 1-20). Moreover, the integrated circuit for detection is also formed in every 100 processing circuit one chip, and uses 20 pieces (IC1-IC20).

[0064] 20 ******s of drawing 11 are mounted in left-hand side (L) at 20 chips (SR 1-1 - SR 1-20) and the bottom (D), and they is carrying out the tangent of control wiring of 100 per one chip, and the signal wiring to the chip by wire bonding respectively. A drawing 11 destructive line part is equivalent to the dashed line section of drawing 9 . Moreover, the connection with the exterior is omitted. Moreover, SWr, SWs, Vr, Vs, RF, etc. are omitted. Although there is an output (Vout) of 20 from the integrated circuits IC1-IC20 for detection, through a switch etc., it collects into one, or these output 20 as they are and should just carry out parallel processing.

[0065] Another operation gestalt is shown in drawing 12 . On ten chips (SR 1-1 - SR 1-10) and right-hand side (R), ten chips (ICs 1-10) are mounted in ten chips (SR 1-11 - SR 1-20) and the bottom, and ten chips (ICs 11-20) are mounted in left-hand side (L) at the bottom (D). Since this composition has distributed each wiring at a time to a top, the bottom, the left, and right-hand side (U, D, L, R) 1000, respectively, the density of wiring of each side becomes small, and its density of wire bonding of each side is also small, and its yield improves. Distribution of wiring sets to g2, g4, g6, --, g2000 in left-hand side (L) on g1, g3, g5, --, g1999, and right-hand side (R), that is, distributes left-hand side (L) and the even-numbered control line to right-hand side (R) for the odd-numbered control line. If it carries out like this, since each wiring is pulled out and wired at equal intervals, its yield will improve without concentration of density. Moreover, what is necessary is just to distribute similarly wiring to the top (U) down side (D).

[0066] Moreover, although not illustrated, distribution of the wiring as another operation gestalt distributes g101-g200, g301-g400, --, g1901-g2000 to left-hand side (L) on g1-g100, g201-g300, --, g1801-g1900, and right-hand side (R), that is, distributes the control line [****] the whole chip, and distributes this alternately with the left and the right (L, R). If it carries out like this, it is controllable to continuation, and drive timing is easy, and does not need to complicate a circuit, and the inside of 1 chip can use a cheap thing. The same is said of a top (U) and the bottom (D), and a circuit possible [processing / ****] and cheap can be used.

[0067] Moreover, after drawing 11 and drawing 12 form the circuit of the dashed line section on one substrate, a chip may be mounted on the substrate and the circuit board and the chip of the dashed line section may be mounted on another big substrate. Moreover, a chip may be mounted on a flexible substrate, and may stick and carry out a tangent to the circuit board of the dashed line section.

[0068] Moreover, although the photoelectrical inverter of such a large area that has many pixels very much was impossible at the complicated process using the conventional photosensor, since the process of the photoelectrical inverter of this invention forms each element simultaneously by the common film, it has few processes, and since it can be managed with a simple process, the quantity yield is possible for it and it is enabling production of a large area and a highly efficient photoelectrical inverter by the low cost.

[0069] The optoelectric transducer concerning this invention is not limited to what was shown with this operation gestalt so that clearly from the above explanation. That is, there are an insulating layer which prevents the first electrode layer, hole, and electron transfer, a photo-electric-translation semiconductor layer, and the second electrode layer, and there should just be a pouring blocking layer which prevents pouring of the hole to a photo-electric-translation semiconductor layer between the second electrode layer and a photo-electric-translation semiconductor layer.

[0070] Moreover, in the above explanation, a hole and an electron may be made reverse and may be constituted. For example, ****** [the number of pouring blocking layers / p]. In this case, impression of voltage or electric field is made reverse, and it will become the same operation if other composition sections are constituted. Furthermore, the photo-electric-translation semiconductor layer should just have the photoelectrical converter ability which light carries out incidence and generates an electron and a hole pair. Lamination may not come out further, either, and may be constituted from a multilayer, and the property may be changing continuously.

[0071] In TFT, there should just be a gate electrode, a gate insulator layer, a semiconductor layer in which channel formation is possible, an ohmic-contact layer, and a main electrode similarly. For example, there ****** p ohmic-contact layers, make voltage of control of a gate electrode reverse in this case, and should just use a hole as a carrier.

[0072] [Operation gestalt 2] drawing 13 is the cross-section block diagram of the X-ray image pck-up equipment in which the 2nd operation gestalt of this invention is shown, and consists of insulating substrates 400 by which the protective-layer 403 grade which protects the grid 903 which consists of the matter 200 which absorbs an X-ray, and the matter 201 which penetrates an X-ray, the fluorescent substance 904 which changes an X-ray into the light and an optoelectric transducer 401 and a switching element 402, and them from a top was formed. The lamination of an optoelectric transducer 401 or a switching element 402 is completely the same as drawing 5 , and the number of each class of it is the same as that of drawing 5 . However, the photoelectrical inverter portion (401, 402, and other wiring) in drawing 13 does not express 2 bits (adjacent 2 bits) like drawing 5 which continued geometrically, and 2 bits chosen arbitrarily show it. In future explanation, it considers as Sensor A and Sensor B as these 2 bits are specified in drawing 13 . The light-receiving area of these sensors is shown by "S" as shown by drawing 13 . Moreover, the size of the matter 200 which absorbs an X-ray, and the matter 201 which penetrates an X-ray is set to "A" and "T", respectively, and let the sum "A+T" of "A" and "T" be the pitch of a grid. And suppose that each size ("S", "A", "T") is considered here only in the direction of a grid pitch (one dimension) (the direction of

X shown within drawing 13).
[0073] The feature in drawing 13 is that the size "S" of the light-receiving area of a sensor is equal to the pitch ("A+T") of a grid. The phase of a grid [as opposed to the light-receiving area in Sensor A (sensor on the left-hand side of drawing 13)] has gathered, and the relation of "S"= "A+B" is understood. By Sensor A, the X-ray which penetrated the matter field 201 which penetrates an X-ray by one will change to the light with a fluorescent substance 904, and photo electric translation will be carried out by Sensor A by the quantity of light. On the other hand, by Sensor B, as shown in drawing 13 , the phase relation of a grid to light-receiving area does not necessarily become the same as Sensor A. The pitch (referred to as "SP") of a sensor (optoelectric transducer) depends this on having not made it the same pitch as the pitch of a grid.
[0074] Usually, though a uniform light is irradiated when a grid pitch differs from a sensor pitch, the distribution of an output occurs from the difference in a spatial phase, and a periodic shade is caused on a picture. Generally, this phenomenon is called moire. When moire is produced, the grace of the picture as X-ray image pck-up equipment will fall greatly.
[0075] However, since it is equal to the pitch "A+T" of a grid, the light-receiving area "S" of Sensor B of the quantity of light by which photo electric translation is carried out by Sensor B is equal to the amount of fluorescence by the X-ray with which only the part passed even through the radioparency matter field 201 (it sets on Sensor B and is "S"= "T+A1+A2").
[0076] That is, by making the pitch "T+A" of a grid equal with the light-receiving area "S" of an optoelectric transducer, it is not dependent on the phase relation of the grid on an optoelectric transducer (200 and 201) at all, and a photo-electric-translation output with every equal optoelectric transducer is obtained.
[0077] Drawing 16 is drawing in which the light-receiving area "S" of an optoelectric transducer showed the case of the pitch "T+A" of a grid of being equal to double precision ("S" ="T+A" *2). Sensor A and a sensor B -- (-- the sensor arranged in which position -- also setting --) and the radioparency matter field 201 in a grid -- photo electric translation of the fluorescence by the X-ray which passed a part for two is carried out, the photo-electric-translation output independent of the phase relation of a grid to a light-receiving side "S" is obtained, and the effect is the same as what is shown by drawing 13 furthermore -- although not illustrated -- " -- S"=" -- the same is said of the T+A"*N (N:3 or more integers) -- obvious -- it is .

[0078] By drawing 13 and drawing 16 , the cross-section block diagram of X-ray image pck-up equipment was taken for the example of this invention for the example, and as long as only the direction of one dimension boils the pitch of a grid, it has explained. In other words, it is an example using the grid shown in drawing 2 , and, needless to say, the effect of the invention in this case is restricted to a 1-dimensional field. However, the checker-grid which made the X-ray absorption matter 200 and the radioparency matter 201 arrange over a two-dimensional field with natural [carry out and] since this invention relates to two-dimensional X-ray image pck-up equipment is used. Make the pitch ("TX+AX" and "TY+AY") of the grid of the direction of X, and the direction of Y into twice [positive-integer] the size (SX and SY) of the light-receiving side of the optoelectric transducer corresponding to each direction, namely, it is "SX" ="TX+AX" *NX (NX : positive integer).
"SY" ="TY+AY" *NY (NY : positive integer)
By carrying out, it cannot be overemphasized that an effect of the invention is expected to X and Y both directions.
[0079] The rough perspective diagram of such X-ray image pck-up equipment is shown in drawing 17 (the optoelectric-transducer section omits).
[0080] [Operation gestalt 3] drawing 14 and drawing 15 are the cross-section block diagrams of the X-ray image pck-up equipment in which the 3rd operation gestalt of this invention is shown. About the same composition member as drawing 13 , the same sign as the member of drawing 13 is described.
[0081] In drawing 15 , Sensor A and Sensor B are the same optoelectric transducers, and to the sensor pitch "Sp", its pitch of a grid (200,201) is equal and they have shown the example when those phase relations differ. Since the sensor light-receiving side is arranged at the shadow section of the X-ray absorption matter 200 which constitutes a grid so that drawing 15 may show, the most is not made as the quantity of light of a sensor. However, since a grid pitch and the sensor pitch are equal, moire does not occur by any means. Moreover, since the grid is used, of course, it has the advantage in which the scattered X-rays within a human body are removable. That is, the shade or striped pattern which do not exist in a photographic subject do not appear on an X-ray picture, and very good quality of image can be obtained.
[0082] In drawing 14 , a grid pitch ("T+A") and a sensor pitch ("Sp") are equal, and the light-receiving side of Sensor A and Sensor B is arranged just under the radioparency matter 201 with which those spatial phase relations constitute a grid. By making it such physical relationship, the quantity of light received in respect of light-receiving of a sensor serves as the maximum. That is, the signal output as X-ray image pck-up equipment can be made into the maximum, and it becomes possible to take large S/N. That is, offer of X-ray image pck-up equipment which obtains high definition further is attained from the equipment shown by drawing 15 .
[0083] Moreover, although drawing 14 and drawing 15 have explained the sensor pitch ("Sp") and the grid pitch ("T+A") only within the direction of one dimension using the example of cross-section composition of the X-ray image pck-up equipment at the time of making it equal, as explained also in drawing 17 of the operation gestalt 2, nothing is limited to one dimension. Namely, migrate to a two-dimensional field and the grid (drawing 17) of the shape of a checker which made the X-ray absorption matter 200 and the radioparency matter 201 arrange is used. Make the grid pitch ("Tx+Ax", "Ty+Ay") of the direction of X, and the direction of Y equal to the pitch ("Spx", "Spy") of the optoelectric transducer corresponding to each direction. That is, the effect shows up to X and Y both directions by considering as "Spx"="Tx+Ax""Spy"= "Ty+Ay", arranging the quantity of light in respect of sensor light-receiving so that it may become the maximum as a spatial phase

relation is shown in drawing 14 , and giving it similarly to two-dimensional.
[0084] Furthermore, "Spx" ="Tx+Ax" *Nx (Nx : positive integer)
"Spy" ="Ty+Ay" *Ny (Ny : positive integer)
the effect is the same even if it extends -- obvious -- it is .
[0085]
[Effect of the Invention] Since according to this invention the reduction optical system which contains a lens by taking the composition in which the two-dimensional picture reader and the X-ray visible conversion fluorescent substance were stuck on parenchyma can make small sharply unnecessary hatchet X-ray image pck-up equipment and the fluorescence from an X-ray visible conversion fluorescent substance can be effectively used on an optoelectric transducer as explained above, offer of the high equipment of S/N is attained. Moreover, by providing a grid, the component by the scattered X-rays in the inside of the body can be removed, and a good X-ray picture with high resolution is obtained. And since the film is not used, it can treat as digital value, the output, i.e., the X-ray picture data, from an optoelectric transducer, and if general-purpose hardness and software are used, they can be performed at high speed and easily [data processing].
[0086] And without the size of the light-receiving side of an optoelectric transducer being dependent on the physical relationship of a two-dimensional picture reader and a grid by being equal to a grid pitch, or a grid pitch being equal N times (N:2 or more positive numbers), and carrying out in the direction of a pitch of a grid, generating of the moire by the spatial phase shift is lost completely, and can offer the good X-ray image pck-up equipment of quality of image. And if the physical relationship of a two-dimensional picture reader and a grid is free, it is not necessary to perform delicate positioning especially on manufacture, and a manufacturing cost can also be lowered. In addition, offer becomes possible as equipment with the high reliability that durability can be carried out to the bottom of environment with much vibration like the medical checkup bus carrying X-ray image pck-up equipment.
[0087] Moreover, by a grid pitch being equal N times (N:1 or more integers), and carrying out the pitch of the array of an optoelectric transducer, and doubling the physical relationship of an optoelectric transducer and a grid so that it may become the maximum about the signal output of an optoelectric transducer in that case, S/N as X-ray image pck-up equipment can be made high, and the precision of a diagnosis improves.
[0088] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, If constituted from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer, thin film production equipments, such as the existing CVD system and a sputtering system, can be used, and offer of the X-ray image pck-up equipment of a large area will be attained.
[0089] Into a hospital, to say nothing of the ability to aim at the steep medical-examination efficiency rise which is not in the former, construction of diagnostic-information networks all over the country is attained, and, according to this invention, the efficiency of a diagnosis of the whole medical community is gathered.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] Especially this invention relates to medical-application X-ray-diagnosis equipment about the high X-ray image pck-up equipment of a S/N ratio by the large area.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Now, with the X-ray image pck-up equipment used for a medical diagnosis, the fluorescent substance made to change into the light the X-ray which was made to carry out exposure of the X-ray to a human body, and penetrated the human body is made to irradiate, and the method which makes a film expose the fluorescence is in use (it is called a film method below).

[0003] Drawing 18 is drawing showing the outline composition of the X-ray-diagnosis equipment by the film method. In drawing 18 , 901 is an X line source to which a patient is made to do exposure of the X-ray, and X-ray intensity and exposure time are adjusted according to the diagnostic purpose. X-rays are scattered about in all the directions within a human body (patient) 902. Then, the making the resolution of an X-ray picture increase purpose, only the X-ray of the specific direction which has used the grid board of 903 is drawn by the fluorescent substance (scintillator) 904.

[0004] In a scintillator 904, the parent matter of a fluorescent substance is excited by the high X-ray of energy (absorption), and the fluorescence of a visible region is acquired by the recombination energy at the time of recombining. the fluorescence -- CaWO4 CdWO4 etc. -- there are some which are depended on the emission center matter activated in parents, such as a thing, CsI:Tl, ZnS:Ag, etc. which are depended on the parent itself Recently, the fluorescent substance which used rare earth elements like Tb, Eu, and Pr for the emission center has also come to be used.

[0005] The matter (for example, lead) which absorbs an X-ray, and the matter (for example, aluminum) which penetrates an X-ray are arranged in by turns, and the grid board has cross-section composition like drawing 2 .

[0006] The fluorescence from a scintillator 904 is exposed by the film of 905, and a patient's X-ray picture is obtained through a development.

[0007] Moreover,-dimensional [1] or a two-dimensional CCD solid state image pickup device is used instead of a film 905, and there is also X-ray image pck-up equipment that carry out image formation of the fluorescence from a scintillator 904, and it carries out photo electric translation with reduction optical system.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Since according to this invention the reduction optical system which contains a lens by taking the composition in which the two-dimensional picture reader and the X-ray visible conversion fluorescent substance were stuck on substance can make small sharply unnecessary hatchet X-ray image pck-up equipment and the fluorescence from an X-ray visible conversion fluorescent substance can be effectively used on an optoelectric transducer as explained above, offer of the high equipment of S/N is attained. Moreover, by providing a grid, the component by the scattered X-rays in the inside of the body can be removed, and a good X-ray picture with high resolution is obtained. And since the film is not used, it can treat as digital value, the output, i.e., the X-ray picture data, from an optoelectric transducer, and if general-purpose hardness and software are used, they can be performed at high speed and easily [data processing].

[0086] And without the size of the light-receiving side of an optoelectric transducer being dependent on the physical relationship of a two-dimensional picture reader and a grid by being equal to a grid pitch, or a grid pitch being equal N times (N:2 or more positive numbers), and carrying out in the direction of a pitch of a grid, generating of the moire by the spatial phase shift is lost completely, and can offer the good X-ray image pck-up equipment of quality of image. And if the physical relationship of a two-dimensional picture reader and a grid is free, it is not necessary to perform delicate positioning especially on manufacture, and a manufacturing cost can also be lowered. In addition, offer becomes possible as equipment with the high reliability that durability can be carried out to the bottom of environment with much vibration like the medical checkup bus carrying X-ray image pck-up equipment.

[0087] Moreover, by a grid pitch being equal N times (N:1 or more integers), and carrying out the pitch of the array of an optoelectric transducer, and doubling the physical relationship of an optoelectric transducer and a grid so that it may become the maximum about the signal output of an optoelectric transducer in that case, S/N as X-ray image pck-up equipment can be made high, and the precision of a diagnosis improves.

[0088] The amorphous silicon-nitride insulating layer which prevents passage of the 1st metal thin film layer, electron, and a hole for the aforementioned optoelectric transducer from the aforementioned insulating-substrate side as a lower electrode (a-SiNx), If constituted from a pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, and the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer, thin film production equipments, such as the existing CVD system and a sputtering system, can be used, and offer of the X-ray image pck-up equipment of a large area will be attained.

[0089] Into a hospital, to say nothing of the ability to aim at the steep medical-examination efficiency rise which is not in the former, construction of diagnostic-information networks all over the country is attained, and, according to this invention, the efficiency of a diagnosis of the whole medical community is gathered.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Also globally, as for Japan which can be going an aging society, improvement in the diagnostic efficiency in a hospital and medical equipment with a more high precision are desired strongly from the first. In the X-ray image pck-up equipment in the conventional film method, it has the trouble described below in such situations.
[0009] Since there will be a development process of a film on the way by the time a doctor gets a patient's X-ray picture, it takes time and effort and time.
[0010] Moreover, when neither the case where the patient has moved during X-ray photography as a time, nor exposure suits, redo of photography is obliged again. These are factors which bar the improvement in efficiency of medical examination in a hospital.
[0011] Moreover, in order to obtain the X-ray picture needed for a diagnosis since a clear X-ray picture is not obtained depending on the angle whose picture the affected part which it is going to photo takes, a photography angle may have to be changed and several sheets may have to be photoed. Especially this is not a desirable thing when patients are infants and a pregnant woman.
[0012] Furthermore, it is necessary to carry out period storage, the number of sheets of the film in a hospital serves as a huge amount, and the photoed X-ray picture film is not efficient in respect of management in the hospital which is in a hospital of being as put **** [, and]. [taking out to the degree of a visit to the hospital of a patient] Moreover, when the case where the patient who is present in a remote place needs to receive a diagnosis of the university hospital average in center of Tokyo, and a patient remove to overseas, and when [other] a hospital must be changed by a certain reason, you have to send the X-ray film photoed until now to the next hospital by a certain method. Otherwise, you have to retake a photograph again in the hospital which newly goes to hospital regularly.
[0013] These things serve as a serious obstacle, when aiming at future new medical society. In this invention, it sets it as the 1st purpose to solve the technical problem explained above.
[0014] In the medical industry, the demand of "digitization of X-ray picture information" is increasing in recent years. If X-ray picture information can be managed using a record medium like a magneto-optic disk if digitization is attained, a doctor can acquire the X-ray picture information of the patient in the optimal angle for real time and facsimile, other communication modes, etc. are used, a patient's X-ray picture information will become possible [sending even to a hospital of what among the world for a short time]. Furthermore, if the acquired digital X-ray picture information performs an image processing using a computer, a diagnosis in a still higher precision will be attained compared with the former, and all the above-mentioned technical problems in the conventional film method will be solved.
[0015] Recently, the X-ray image pck-up equipment of "digitization of X-ray picture information" which used the CCD solid state image pickup device instead of the film to reply to a demand is also considered.
[0016] However, for the moment, a CCD solid state image pickup device is unproducible by the comparable size in the size of a human body. When using a CCD solid state image pickup device, it is necessary to make a CCD light-receiving side carry out image formation of the fluorescence, i.e., X-ray image, from a scintillator with reduction optical system. The problem that it is difficult to make reduction optical system containing a lens small, and X-ray image pck-up equipment is enlarged arises.
[0017] Moreover, in order to carry out image formation through a lens, the light which does not carry out incidence to a lens becomes useless. Therefore, although it is dependent also on reduction percentage, the light included in a lens decreases to 1 / 100 - 1/1000, it is said that 2 figures - 3 figures of S/N (signal) ratios are generally downed [before letting a lens pass], and a bird clapper is expected to be disadvantageous when using for the medical equipment with which high gradation nature is demanded.
[0018] [Objects of the Invention] -- as stated above, by this invention, it aims at offer of the X-ray image pck-up equipment of the next generation which is excellent in a space factor and can take a high S/N ratio which can aim at the efficiency rise of the medical examination which is not obtained, and is not in a CCD method by the conventional film method

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[Translation done.]

MEANS

[Means for Solving the Problem] this invention offers the following meanses in order to solve the technical problem mentioned above.
[0020] [1] The two-dimensional picture reader which formed two or more optoelectric transducers in the shape of two-dimensional on the insulating substrate, The fluorescent substance which will be changed into the light if the X-ray formed by sticking substantially on the aforementioned two-dimensional picture reader is irradiated, X-ray image pck-up equipment characterized by having the grid board which was formed between the aforementioned fluorescent substance and X line source, and which derives only the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, and being constituted.
[0021] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). [2] The aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray serve as a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- the above -- an optoelectric transducer -- light-receiving -- a field -- the above -- a grid -- a pitch -- a direction -- a size -- the above -- a grid -- a board -- a pitch -- being equal -- or -- or -- the above -- a grid -- a board -- a pitch -- N -- a time (N:2 or more positive numbers) -- being equal -- things -- the feature -- ** -- carrying out -- [-- one --] -- a publication -- an X-ray -- an image pck-up --
[0022] One optoelectric transducer from which the aforementioned two-dimensional picture reader serves as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). [3] The aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray become a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- the above -- a sensor -- a pitch -- the above -- a grid -- a pitch -- being equal -- or -- the above -- a grid -- a pitch -- N -- a time (N:2 or more positive numbers) -- being equal -- things -- the feature -- ** -- carrying out -- [-- one --] -- a publication -- an X-ray -- an image pck-up -- equipment .
[0023] [4] X-ray image pck-up equipment given in [3] characterized by providing the physical relationship of the aforementioned two-dimensional picture reader and the aforementioned grid from which the signal output of the aforementioned optoelectric transducer serves as the maximum.
[0024] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side [5] The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, X-ray image pck-up equipment given in either of [1] - [4] characterized by constituting from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer.
[0025]
[Embodiments of the Invention]

[Translation done.]

OPERATION

The two-dimensional picture reader which the X-ray image pck-up equipment concerning a [operation] this invention made form two or more optoelectric transducers in the shape of two-dimensional on an insulating substrate, Between the fluorescent substance which will be changed into the light if the X-ray stuck on the aforementioned two-dimensional picture reader is irradiated, and the aforementioned fluorescent substance and X line source By constituting from a grid board formed in order to derive only the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, without using a film, an X-ray picture can be obtained and data processing also becomes easy.

[0026] Moreover, since the reduction optical system containing a lens is unnecessary, the operation which can miniaturize the whole X-ray image pck-up equipment is obtained.

[0027] Furthermore, since the light from a fluorescent substance can use almost, the high X-ray image pck-up equipment of a S/N ratio can be offered.

[0028] even if to say nothing of the efficiency of a large medical examination rising in a hospital by this construction of the diagnostic-information network in the whole country is attained and it is in a remote place, the medicine of a hospital in the center of Tokyo can receive -- like -- the diagnostic efficiency in the whole medical community is gathered

[0029] Moreover, since the grid is prepared, operation of removing the scattered X-rays in the inside of the body is obtained.

[0030] Moreover, it sets to the two-dimensional picture reader which constitutes the X-ray image pck-up equipment of this invention. One optoelectric transducer used as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). the aforementioned grid board It is arranged in the one direction and sets to the aforementioned optoelectric transducer. the matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray -- a couple -- becoming -- a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- When the pitch of a grid board is equal N times (N:2 or more positive numbers) and the size of the direction of a grid pitch of the light-receiving side makes it equal to the pitch of a grid board, moire does not occur but offer of the reliable X-ray image pck-up equipment of high resolution is attained.

[0031] Moreover, the two-dimensional picture reader which constitutes another X-ray image pck-up equipment of this invention One optoelectric transducer used as a pixel is arranged in the direction of X, and the direction of Y at intervals of a certain fixed distance (sensor pitch). the aforementioned grid board The matter (A) which absorbs an X-ray, and the matter (B) which penetrates an X-ray serve as a couple. It is arranged in the one direction. a certain fixed distance interval (grid pitch) -- Above X or the direction of Y -- at least -- either -- When it is equal to a grid pitch, or a grid pitch is equal N times (N:2 or more positive numbers) and the aforementioned sensor pitch carries out, there is an operation which prevents generating of moire. Furthermore, by providing the physical relationship of the aforementioned two-dimensional picture reader and the aforementioned grid from which the signal output of the aforementioned optoelectric transducer serves as the maximum, there is operation that the S/N ratio as X-ray image pck-up equipment becomes large.

[0032] The aforementioned optoelectric transducer as a lower electrode from the aforementioned insulating-substrate side The 1st metal thin film layer, The amorphous silicon-nitride insulating layer which prevents passage of electron and a hole (a-SiNx), The pouring blocking layer of the P type which prevents pouring of a hydrogenation amorphous silicon photo-electric-translation layer (a-Si:H), the pouring blocking layer of the N type which prevents pouring of a hole carrier, or an electron carrier, If constituted from the 2nd metal thin film layer arranged as an up electrode to the part on a transparent conductive layer or the aforementioned pouring blocking layer Thin film production equipments, such as the existing CVD system and a sputtering system, can be used easily, the image pck-up portion of X-ray image pck-up equipment is made to a large area, and there is operation that moreover it is cheaply producible. And it is thinly small by constituting using the grid of the aforementioned photoelectrical inverter section and the same size, and an X-ray visible conversion fluorescent substance, and the high X-ray image pck-up equipment of an S/N can offer, and since the X-ray picture data obtained by that cause can use together with digital technology easily, the operation effect which raises the diagnostic efficiency of the future whole medical community sharply brings about. Hereafter, the operation gestalt of this invention is explained in detail based on a drawing.

[0033] [Operation gestalt 1] drawing 1 is the whole X-ray image pck-up equipment block diagram showing the 1st operation gestalt of this invention. In drawing 1 , the X-ray from the X line source 901 is irradiated by the human body 902, absorption, transparency, and dispersion take place within a human body according to in-the-living-body matter, such as lungs, a bone, a

vessel, or the focus, and the X-ray which has passed through the inside of a human body goes in the direction of a grid 903.
[0034] Drawing 2 and drawing 3 are drawings showing the cross-section composition of a grid, and the matter 200 (for example, lead) with which a grid absorbs an X-ray, and the matter 201 (for example, aluminum) which penetrates an X-ray are arranged by turns. It is in preventing the fall of the resolution by the X-ray scattered about in the body as a reason for preparing a grid. That is, the X-ray which only the X-ray of the specific direction (the direction of a cross section of a grid) passed the radioparency matter 201, reached the scintillator (fluorescent substance) 904, and were scattered about in the body is absorbed by the absorber 200 of a grid, and cannot reach a scintillator.
[0035] The X-ray irradiated by the scintillator 904 is excited with a fluorescent substance within a scintillator (absorption), and the fluorescence near the spectral sensitivity wavelength field of an optoelectric transducer 401 is emitted from a scintillator.
[0036] A fluorescent substance and the stuck optoelectric transducer 401 carry out photo electric translation of the fluorescence to which the X-ray image from a scintillator 904 corresponds, and although not illustrated by drawing 1 with a switching element 402, a signal charge is transmitted to processing circuits (AMP, A-D converter, etc.).
[0037] What is necessary is here, to have not stuck the fluorescent substance completely with an optoelectric transducer, and just to have stuck it substantially. "Substantial adhesion" is arranging a fluorescent substance at an interval small enough to a sensor pitch. If it does in this way, light cannot fully be used and a picture will not necessarily fade.
[0038] In order that an optoelectric transducer 401 and a switching element 402 may be made on an insulating substrate 400 and may protect an element on 401,402, they are covered by the protective coat 403.
[0039] Drawing 2 and drawing 3 are drawings having shown the cross section of the grid which consists of drawing 1 . In drawing 2 , it is the grid used when X line source is installed comparatively far away, and the X-ray absorption matter (Pb) and the radioparency matter (aluminum) are the types arranged in parallel. On the other hand, in the cross-section composition, the grid shown in drawing 3 has the structure where the X-ray absorption matter (Pb) and the radioparency matter (aluminum) were turned in the direction of the X line source 901, when the distance of X line source and a grid is in comparatively near physical relationship, it is used, and it has an advantage in space as an X-ray image pck-up device. Moreover, since the X-ray which was passed directly in the case of the grid of drawing 3 , without being absorbed and scattered about in a body is directly irradiated by the scintillator as it is, brighter fluorescence is acquired and a S/N ratio becomes advantageous.
[0040] Drawing 4 is a plan showing the two-dimensional optoelectric transducer and two-dimensional switching element of a photoelectrical inverter portion for 4 pixels in the X-ray image pck-up equipment of this invention. The hatching section 405 in drawing is a light-receiving side which receives the fluorescence from a scintillator. 402 is a switching element which transmits the signal charge by which photo electric translation was carried out by the optoelectric transducer 401 to a processing circuit side, and the control line by which 408 controls the switching element, and 409 are signal lines connected in a processing circuit. 410 is a power supply line which gives bias to an optoelectric transducer. Moreover, 420 is a contact hole for connecting an optoelectric transducer 401 and a switching element 402.
[0041] Drawing 5 is the cross section cut by A-B in drawing 4 . Here explains the formation method of the photoelectrical inverter section in this invention.
[0042] First, on an insulating substrate 400, by the spatter or the resistance heating method, the about 500A vacuum evaporationo of the 1st metal thin film layer 421 is carried out, patterning of the chromium (Cr) is carried out by photo lithography, and unnecessary area is **********ed. This 1st metal thin film layer 421 serves as a lower electrode of an optoelectric transducer 401, and a gate electrode of a switching element 402.
[0043] next, CVD -- the inside of the same vacuum -- a-SiNx (425), a-Si:H (426), and N+ layer (427) -- respectively -- 2000 -- the laminating of every 5000 or 500A is carried out one by one These each class is the insulating layer / photo-electric-translation semiconductor layer / hole pouring blocking layer of an optoelectric transducer 401, and turns into a gate insulator layer / semiconductor layer / ohmic-contact layer of a switching element 402 (TFT). Moreover, it is used also as an insulating layer of the cross section (430 of drawing 4) of the 1st metal thin film layer 421 and the 2nd metal thin film layer 422. The thickness of each class is designed by not only the above-mentioned thickness but the voltage used as a photoelectrical inverter, a charge, the amount of incidence fluorescence from a scintillator, etc. the optimal. At least, it is a-SiNx. 500A or more which cannot pass through electron and a hole and can function enough as a gate insulator layer of TFT is desirable.
[0044] After depositing each class, dry etching of the area used as a contact hole (420 references of drawing 4) is carried out by RIE or CDE, and about 10000A (aluminum) of aluminum is made to deposit in a spatter or a resistance heating method as 2nd metal thin film layer 422 after that. Furthermore, patterning is carried out by photo lithography, and unnecessary area is **********ed.
[0045] The 2nd metal thin film layer serves as wiring of the up electrode of an optoelectric transducer 401, the source of Switching TFT, a drain electrode, and others etc. Moreover, an up-and-down metal thin film layer is connected in the contact hole section simultaneously with membrane formation of the 2nd metal thin film layer 422.
[0046] Furthermore, in order to form the channel section of TFT, it **********s by the RIE method in a source electrode and drain inter-electrode [a part of], and it is unnecessary a-SiNx after that. A layer, an a-Si:H layer, and N+ layer are **********ed by the RIE method, and each element is separated. Now, an optoelectric transducer 401, switching TFT 402, other wiring (408,409,410), and the contact hole section 420 are formed.

[0047] Although only 2 pixels is not illustrated in the cross section of drawing 5 , it cannot be overemphasized that many pixels are simultaneously formed on an insulating substrate 400. To the last, it is SiNX in each element and wiring as a purpose on a moisture-proof disposition. It covers with the passivation film (protective coat) 403.
[0048] An optoelectric transducer, Switching TFT, and wiring are formed only by etching of the 1st common metal thin film layer and a-SiNx which were deposited simultaneously, a-Si:H, N+ layer and the 2nd metal thin film layer, and each class as the above explanation. Moreover, a pouring blocking layer has only one place into an optoelectric transducer, and it is formed within the same vacuum layer.
[0049] Here, device operation of optoelectric-transducer 401 simple substance currently used with this operation gestalt is explained.
[0050] Drawing 6 (a) and (b) are the energy-band views of an optoelectric transducer showing operation of the refreshment mode of this operation gestalt, and a photoelectrical translation mode, respectively, and express the state of the thickness direction of each class of drawing 5 . 602 is the lower electrode (it is described as G electrode below) formed by Cr. 607 is the insulating layer formed by SiN from which an electron and a hole prevent passage, and the thickness is set as 500A or more which is thickness to the extent that an electron and a hole are unmovable with the tunnel effect. The photo-electric-translation semiconductor layer in which 604 was formed by i layers of intrinsic semiconductors of hydrogenation amorphous silicon a-Si, the pouring blocking layer of n layers of a-Si from which 605 prevents pouring of the hole to the photo-electric-translation semiconductor layer 604, and 606 are up electrodes (it is described as D electrode below) formed with aluminum.
[0051] Although D electrode has not covered n layers completely with this operation gestalt, since, as for for D electrode and n layers, an electron transfer is performed freely, D electrode and the potential of n layers are always these potentials, and are premised on it by explanation below. This optoelectric transducer has two kinds of operation called refreshment mode and a photoelectrical translation mode by the method of impression of the voltage of D electrode and G electrode.
[0052] In drawing 6 (a) in refreshment mode, the hole where the electronegative potential is given to G electrode, and D electrode was shown by the black dot in i layer 604 is led to D electrode by electric field. i layers of electrons shown with a circle [white] simultaneously are poured into 604. n-layer 605 or i layers, at this time, in 604, some of holes and electrons are recombined and disappear. If this state continues time long enough, the hole in i layer 604 will be swept out from 604 i layers.
[0053] From this state, for making it drawing 6 (b) of a photoelectrical translation mode, an electropositive potential is given to D electrode to G electrode. Then, the electron in i layer 604 is led to D electrode in an instant. However, a hole is not led to 604 i layers, in order that 605 [n-layer] may work as a pouring blocking layer. If light carries out incidence into i layer 604 in this state, light will be absorbed and an electron and a hole pair will generate it. This electron is led to D electrode by electric field, and a hole moves in the inside of i layer 604, and gives i layers to the interface of 604 and an insulating layer 607. However, since it cannot move into an insulating layer 607, it will stop in i layer 604. In order for an electron to move to D electrode at this time, and to move a hole to insulating-layer 607 interface in i layer 604, and to maintain the electrical neutrality in an element, current flows [current] from G electrode. Since this current corresponds to the electron and hole pair generated by light, it is proportional to the light which carried out incidence. If it will be in the state of drawing 6 (a) in refreshment mode again after maintaining drawing 6 (b) of a certain period photoelectrical translation mode, the hole which had stopped at 604 i layers will be led to D electrode as mentioned above, and the current corresponding to this hole will flow simultaneously. The amount of this hole corresponds to the total amount of the light which carried out incidence to the photoelectrical translation-mode period. What is necessary is to carry out the fixed hatchet difference of this amount about, to subtract it, and just to detect it, although the current corresponding to the amount of the electron poured in into i layer 604 at this time also flows. That is, while the optoelectric transducer in this operation gestalt outputs the amount of the light which carries out incidence to real time, it can also output the total amount of the light which carried out incidence to a certain period.
[0054] However, although the period of a photoelectrical translation mode becomes long for a certain reason, or incidence is in light when the illuminance of the light which carries out incidence is strong, current may not flow. This is because many holes stop in i layer 604, the electric field in i layer 604 become small like drawing 6 (c) since it is this hole, and the generated electron is no longer led to D electrode and recombines with the hole in i layer 604. Although current may flow unstably when the state of the incidence of light changes in this state, if it is again made refreshment mode, the current which the hole in i layer 604 was swept out and is proportional to light again in the following photoelectrical translation mode will be acquired.
[0055] Moreover, in the above-mentioned explanation, although an ideal sweeps out all holes when sweeping out the hole in i layer 604 in refreshment mode, it is also effective to sweep out some holes, current equal to the above-mentioned is acquired, and it is satisfactory. That is, what is necessary is for it to be good if it is not in the state of (c) of drawing 6 in the detection opportunity in the following photoelectrical translation mode, and just to decide the property of the period in potential and refreshment mode and the pouring blocking layer of n layer 605 to G electrode of D electrode in refreshment mode. Furthermore, in refreshment mode, i layers of pourings of the electron of 604 are not a requirement, and the potential to G electrode of D electrode is not limited to negative, either. When i layers of many holes have stopped at 604, even if it compares and the potential to G electrode of D electrode is an electropositive potential, the electric field in i layers are because it is added in the direction which leads a hole to D electrode. It is not a requirement that the property of the pouring blocking layer of 605 can pour similarly n layers of i layers of electrons into 604.

[0056] Next, photo-electric-translation operation at the time of extending concretely the optoelectric transducer shown by drawing 7 to two-dimensional, and constituting it is explained. Drawing 9 is a representative circuit schematic showing the photoelectrical inverter arranged to two-dimensional, and drawing 10 is a timing chart which shows the operation.
[0057] S11-S33 show the lower electrode side by the optoelectric transducer, and show the G and up electrode side by D in drawing 9 . T11-T33 are Switching TFT. Vs is a power supply for read-out, Vr is a power supply for refreshment, and it connects with D electrode of all the optoelectric transducers S11-S33 through Switches SWs and SWr, respectively. Switch SWr is directly connected to the refreshment control circuit RF through the inverter, and Switch SWs is controlled so that SWr turns on a refreshment period and SWs turns on the period of on and others. 1 pixel consists of one optoelectric transducer and switching TFT, and the signal output is connected to the integrated circuit IC for detection by signal wiring SIG. A photoelectrical inverter here divides a total of nine pixels into three blocks, transmits a 3 pixels [per block] output simultaneously, through this signal wiring SIG, is changed one by one into an output by the integrated circuit IC for detection, and is outputted (Vout). Moreover, each pixel is arranged in two dimensions by arranging 3 pixels in 1 block in a longitudinal direction, and arranging 3 blocks perpendicularly in order.
[0058] Next, operation of 1 pixel of photoelectrical transducers in the X-ray image pck-up equipment in this operation gestalt is explained using drawing 7 and drawing 8 . Drawing 7 is an equal circuit including the optoelectric transducer for 1 pixel, and Switching TFT, and drawing 8 is a timing chart which shows the operation. First, since an optoelectric transducer 401 is refreshed, where bias power supply 701 is made into a certain voltage value (Vr), Gate Vg (730) and the switching element 705 for reset of switching TFT 402 are turned on. By this, D electrode of an optoelectric transducer 401 is refreshed in Vr, G electrode is refreshed on the bias VBT of the power supply 707 for reset (Vr<VBT), and an optoelectric transducer will be in an accumulation state (readout mode) after this operation. Then, the X line source 901 is turned on, the X-ray which passed the human body and the grid 903 is irradiated by the scintillator 904, and ****** photo electric translation of the fluorescence is carried out to an optoelectric transducer 401. a-SiNx which constitutes an optoelectric transducer Since an insulating layer and an a-Si:H photo-electric-translation semiconductor layer are also dielectrics, an optoelectric transducer functions also as capacitative element. That is, the signal charge by which photo electric translation was carried out by the optoelectric transducer is accumulated in an optoelectric transducer. Then, Vg of TFT is made to turn on and the signal charge in an optoelectric transducer is transmitted to capacitative element 713. Especially the capacitative element 713 is not necessarily formed as a drawing 4 top element, and is inevitably formed in the cross section 430 grade of a vertical inter-electrode capacity of TFT, a signal line 409, and the gate line 408. Of course, according to a design, you may make separately as an element. The above operation is performed by the amorphous device formed on the insulating substrate except for the gate control of current supply or TFT. Then, the signal charge of capacitative element 713 is transmitted to capacity 720 by the switching element 725 in a processing circuit, and a signal is outputted by the operational amplifier 721. Then, capacity 720 is reset by the switch 722, capacitative element 713 is reset by the switch 705, and operation for 1 pixel is completed.
[0059] Next, operation of the X-ray image pck-up equipment portion of this operation gestalt is explained using drawing 9 and drawing 10 .
[0060] The control wiring g1-g3 is first impressed by shift registers SR1 and SR2, and Hi is impressed to s1-s2. then, the object for a transfer -- switching TFT-T11-T33 and switches M1-M3 flow, and G electrode of all the optoelectric transducers S11-S33 becomes GND potential (since the input terminal of the integral-detection machine Amp is designed by GND potential) The refreshment control circuit RF outputs Hi simultaneously, Switch SWr turns on, and D electrode of all the optoelectric transducers S11-S33 becomes right potential by the power supply Vr for refreshment. Then, all the optoelectric transducers S11-S33 become refreshment mode, and are refreshed. Next the refreshment control circuit RF outputs Lo, Switch SWs turns on, and D electrode of all the optoelectric transducers S11-S33 becomes right potential by the power supply Vs for reading. Then, all the optoelectric transducers S11-S33 become a photoelectrical translation mode. Lo is impressed to the control wiring g1-g3, and s1-s2 by shift registers SR1 and SR2 in this state. then, the object for a transfer -- the switches M1-M3 of switching TFT-T11-T33 turn off, and although G electrode of all the optoelectric transducers S11-S33 becomes open in DC, since each optoelectric transducer is also a capacitor, potential is held However, at this time, since incidence of the X-ray is not carried out, incidence of the light is not carried out to all the optoelectric transducers S11-S33, and a photocurrent does not flow. Outgoing radiation of the X-ray is carried out in pulse in this state, a human body, a scintillator, etc. are passed and the fluorescence from a scintillator carries out incidence to each optoelectric transducer S11-S33. As for this light, the information on internal structures, such as a human body, is included. The photocurrent which flowed by this light is accumulated in each optoelectric transducer as a charge, and after the incidence end of an X-ray is held. next, a control pulse is impressed by the control wiring g1 with a shift register SR 1 at Hi -- having -- the control pulse impression to the control wiring s1-s3 of a shift register SR 2 -- the object for a transfer -- v1-v3 are outputted one by one through TFT-T11-T13 and switches M1-M3 Other lightwave signals are similarly outputted one by one by control of shift registers SR1 and SR2. Thereby, the 2-dimensional information on internal structures, such as a human body, is acquired as v1-v9. Although it is the operation so far when obtaining a static image, when obtaining a dynamic image, the operation so far is repeated.
[0061] Since it connects in common and D electrode of an optoelectric transducer is controlling this common wiring by this operation gestalt through Switch SWr and Switch SWs to the potential of the power supply Vr for refreshment, and the power supply Vs for reading, all optoelectric transducers can be simultaneously switched to refreshment mode and a photoelectrical translation mode. For this reason, complicated control can be made for there to be nothing and an optical output can be

obtained by one TFT per pixel.
[0062] In drawing 9 , nine 2-dimensional pixels are arranged to 3x3, and simultaneously, 3 pixels of 40cmx40cm X-ray detectors will be obtained at a time, if not only this but 5x5 pixels per 1mm of every direction are arranged in two dimensions as 2000x2000 pixels, although it divided into 3 times and the transfer and the output of were done. If this is combined with an X-ray generator instead of an X-ray film and X-ray roentgen equipment is constituted, it can be used for a thorax roentgen medical checkup or a breast cancer medical checkup. By doing so, it is possible to project the output by CRT in an instant unlike a film, and it is also possible to change an output into digital one further and to change into the output which carried out the image processing by computer and which was doubled with the purpose. Moreover, storage is also possible for a magneto-optic disk, and the past picture can also be searched in an instant. Moreover, sensitivity can also acquire a clear picture through a feeble X-ray with little [it is better than a film and] influence on a human body.
[0063] The conceptual diagram showing mounting of the detector which has 2000x2000 pixels in drawing 11 and drawing 12 is shown. In the element in the dashed line shown by drawing 9 , when it constitutes 2000x2000 detectors, although what is necessary is just to increase a number in all directions, it becomes 2000 to the control wiring g1-g2000 in this case, and signal wiring SIG is also set to sig1-sig2000 to 2000. Moreover, a shift register SR 1 and the integrated circuit IC for detection must carry out control and processing of 2000, and become large-scale. One chip becomes very large and it is disadvantageous at a yield, a price, etc. at the time of manufacture to perform this with the element of one chip, respectively. Then, a shift register SR 1 is formed in every 100-step one chip, and should just use 20 pieces (SR 1-1 - SR 1-20). Moreover, the integrated circuit for detection is also formed in every 100 processing circuit one chip, and uses 20 pieces (IC1-IC20).
[0064] 20 ******s of drawing 11 are mounted in left-hand side (L) at 20 chips (SR 1-1 - SR 1-20) and the bottom (D), and they is carrying out the tangent of control wiring of 100 per one chip, and the signal wiring to the chip by wire bonding respectively. A drawing 11 destructive line part is equivalent to the dashed line section of drawing 9 . Moreover, the connection with the exterior is omitted. Moreover, SWr, SWs, Vr, Vs, RF, etc. are omitted. Although there is an output (Vout) of 20 from the integrated circuits IC1-IC20 for detection, through a switch etc., it collects into one, or these output 20 as they are and should just carry out parallel processing.
[0065] Another operation gestalt is shown in drawing 12 . On ten chips (SR 1-1 - SR 1-10) and right-hand side (R), ten chips (ICs 1-10) are mounted in ten chips (SR 1-11 - SR 1-20) and the bottom, and ten chips (ICs 11-20) are mounted in left-hand side (L) at the bottom (D). Since this composition has distributed each wiring at a time to a top, the bottom, the left, and right-hand side (U, D, L, R) 1000, respectively, the density of wiring of each side becomes small, and its density of wire bonding of each side is also small, and its yield improves. Distribution of wiring sets to g2, g4, g6, --, g2000 in left-hand side (L) on g1, g3, g5, --, g1999, and right-hand side (R), that is, distributes left-hand side (L) and the even-numbered control line to right-hand side (R) for the odd-numbered control line. If it carries out like this, since each wiring is pulled out and wired at equal intervals, its yield will improve without concentration of density. Moreover, what is necessary is just to distribute similarly wiring to the top (U) down side (D).
[0066] Moreover, although not illustrated, distribution of the wiring as another operation gestalt distributes g101-g200, g301-g400, --, g1901-g2000 to left-hand side (L) on g1-g100, g201-g300, --, g1801-g1900, and right-hand side (R), that is, distributes the control line [****] the whole chip, and distributes this alternately with the left and the right (L, R). If it carries out like this, it is controllable to continuation, and drive timing is easy, and does not need to complicate a circuit, and the inside of 1 chip can use a cheap thing. The same is said of a top (U) and the bottom (D), and a circuit possible [processing / ****] and cheap can be used.
[0067] Moreover, after drawing 11 and drawing 12 form the circuit of the dashed line section on one substrate, a chip may be mounted on the substrate and the circuit board and the chip of the dashed line section may be mounted on another big substrate. Moreover, a chip may be mounted on a flexible substrate, and may stick and carry out a tangent to the circuit board of the dashed line section.
[0068] Moreover, although the photoelectrical inverter of such a large area that has many pixels very much was impossible at the complicated process using the conventional photosensor, since the process of the photoelectrical inverter of this invention forms each element simultaneously by the common film, it has few processes, and since it can be managed with a simple process, the quantity yield is possible for it and it is enabling production of a large area and a highly efficient photoelectrical inverter by the low cost.
[0069] The optoelectric transducer concerning this invention is not limited to what was shown with this operation gestalt so that clearly from the above explanation. That is, there are an insulating layer which prevents the first electrode layer, hole, and electron transfer, a photo-electric-translation semiconductor layer, and the second electrode layer, and there should just be a pouring blocking layer which prevents pouring of the hole to a photo-electric-translation semiconductor layer between the second electrode layer and a photo-electric-translation semiconductor layer.
[0070] Moreover, in the above explanation, a hole and an electron may be made reverse and may be constituted. For example, ****** [the number of pouring blocking layers / p]. In this case, impression of voltage or electric field is made reverse, and it will become the same operation if other composition sections are constituted. Furthermore, the photo-electric-translation semiconductor layer should just have the photoelectrical converter ability which light carries out incidence and generates an electron and a hole pair. Lamination may not come out further, either, and may be constituted from a multilayer, and the property may be changing continuously.
[0071] In TFT, there should just be a gate electrode, a gate insulator layer, a semiconductor layer in which channel formation

is possible, an ohmic-contact layer, and a main electrode similarly. For example, there ****** p ohmic-contact layers, make voltage of control of a gate electrode reverse in this case, and should just use a hole as a carrier.
[0072] [Operation gestalt 2] drawing 13 is the cross-section block diagram of the X-ray image pck-up equipment in which the 2nd operation gestalt of this invention is shown, and consists of insulating substrates 400 by which the protective-layer 403 grade which protects the grid 903 which consists of the matter 200 which absorbs an X-ray, and the matter 201 which penetrates an X-ray, the fluorescent substance 904 which changes an X-ray into the light and an optoelectric transducer 401 and a switching element 402, and them from a top was formed. The lamination of an optoelectric transducer 401 or a switching element 402 is completely the same as drawing 5 , and the number of each class of it is the same as that of drawing 5 . However, the photoelectrical inverter portion (401, 402, and other wiring) in drawing 13 does not express 2 bits (adjacent 2 bits) like drawing 5 which continued geometrically, and 2 bits chosen arbitrarily show it. In future explanation, it considers as Sensor A and Sensor B as these 2 bits are specified in drawing 13 . The light-receiving area of these sensors is shown by "S" as shown by drawing 13 . Moreover, the size of the matter 200 which absorbs an X-ray, and the matter 201 which penetrates an X-ray is set to "A" and "T", respectively, and let the sum "A+T" of "A" and "T" be the pitch of a grid. And suppose that each size ("S", "A", "T") is considered here only in the direction of a grid pitch (one dimension) (the direction of X shown within drawing 13).
[0073] The feature in drawing 13 is that the size "S" of the light-receiving area of a sensor is equal to the pitch ("A+T") of a grid. The phase of a grid [as opposed to the light-receiving area in Sensor A (sensor on the left-hand side of drawing 13)] has gathered, and the relation of "S"= "A+B" is understood. By Sensor A, the X-ray which penetrated the matter field 201 which penetrates an X-ray by one will change to the light with a fluorescent substance 904, and photo electric translation will be carried out by Sensor A by the quantity of light. On the other hand, by Sensor B, as shown in drawing 13 , the phase relation of a grid to light-receiving area does not necessarily become the same as Sensor A. The pitch (referred to as "SP") of a sensor (optoelectric transducer) depends this on having not made it the same pitch as the pitch of a grid.
[0074] Usually, though a uniform light is irradiated when a grid pitch differs from a sensor pitch, the distribution of an output occurs from the difference in a spatial phase, and a periodic shade is caused on a picture. Generally, this phenomenon is called moire. When moire is produced, the grace of the picture as X-ray image pck-up equipment will fall greatly.
[0075] However, since it is equal to the pitch "A+T" of a grid, the light-receiving area "S" of Sensor B of the quantity of light by which photo electric translation is carried out by Sensor B is equal to the amount of fluorescence by the X-ray with which only the part passed even through the radioparency matter field 201 (it sets on Sensor B and is "S"= "T+A1+A2").
[0076] That is, by making the pitch "T+A" of a grid equal with the light-receiving area "S" of an optoelectric transducer, it is not dependent on the phase relation of the grid on an optoelectric transducer (200 and 201) at all, and a photo-electric-translation output with every equal optoelectric transducer is obtained.
[0077] Drawing 16 is drawing in which the light-receiving area "S" of an optoelectric transducer showed the case of the pitch "T+A" of a grid of being equal to double precision ("S" ="T+A" *2). Sensor A and a sensor B -- (-- the sensor arranged in which position -- also setting --) and the radioparency matter field 201 in a grid -- photo electric translation of the fluorescence by the X-ray which passed a part for two is carried out, the photo-electric-translation output independent of the phase relation of a grid to a light-receiving side "S" is obtained, and the effect is the same as what is shown by drawing 13 furthermore -- although not illustrated -- " -- S"=" -- the same is said of the T+A"*N (N:3 or more integers) -- obvious -- it is .

[0078] By drawing 13 and drawing 16 , the cross-section block diagram of X-ray image pck-up equipment was taken for the example of this invention for the example, and as long as only the direction of one dimension boils the pitch of a grid, it has explained. In other words, it is an example using the grid shown in drawing 2 , and, needless to say, the effect of the invention in this case is restricted to a 1-dimensional field. However, the checker-grid which made the X-ray absorption matter 200 and the radioparency matter 201 arrange over a two-dimensional field with natural [carry out and] since this invention relates to two-dimensional X-ray image pck-up equipment is used. Make the pitch ("TX+AX" and "TY+AY") of the grid of the direction of X, and the direction of Y into twice [positive-integer] the size (SX and SY) of the light-receiving side of the optoelectric transducer corresponding to each direction, namely, it is "SX" ="TX+AX" *NX (NX : positive integer).
"SY" ="TY+AY" *NY (NY : positive integer)
By carrying out, it cannot be overemphasized that an effect of the invention is expected to X and Y both directions.
[0079] The rough perspective diagram of such X-ray image pck-up equipment is shown in drawing 17 (the optoelectric-transducer section omits).
[0080] [Operation gestalt 3] drawing 14 and drawing 15 are the cross-section block diagrams of the X-ray image pck-up equipment in which the 3rd operation gestalt of this invention is shown. About the same composition member as drawing 13 , the same sign as the member of drawing 13 is described.
[0081] In drawing 15 , Sensor A and Sensor B are the same optoelectric transducers, and to the sensor pitch "Sp", its pitch of a grid (200,201) is equal and they have shown the example when those phase relations differ. Since the sensor light-receiving side is arranged at the shadow section of the X-ray absorption matter 200 which constitutes a grid so that drawing 15 may show, the most is not made as the quantity of light of a sensor. However, since a grid pitch and the sensor pitch are equal, moire does not occur by any means. Moreover, since the grid is used, of course, it has the advantage in which the scattered X-rays within a human body are removable. That is, the shade or striped pattern which do not exist in a photographic subject do not appear on an X-ray picture, and very good quality of image can be obtained.

[0082] In drawing 14 , a grid pitch ("T+A") and a sensor pitch ("Sp") are equal, and the light-receiving side of Sensor A and Sensor B is arranged just under the radioparency matter 201 with which those spatial phase relations constitute a grid. By making it such physical relationship, the quantity of light received in respect of light-receiving of a sensor serves as the maximum. That is, the signal output as X-ray image pck-up equipment can be made into the maximum, and it becomes possible to take large S/N. That is, offer of X-ray image pck-up equipment which obtains high definition further is attained from the equipment shown by drawing 15 .

[0083] Moreover, although drawing 14 and drawing 15 have explained the sensor pitch ("Sp") and the grid pitch ("T+A") only within the direction of one dimension using the example of cross-section composition of the X-ray image pck-up equipment at the time of making it equal, as explained also in drawing 17 of the operation gestalt 2, nothing is limited to one dimension. Namely, migrate to a two-dimensional field and the grid (drawing 17) of the shape of a checker which made the X-ray absorption matter 200 and the radioparency matter 201 arrange is used. Make the grid pitch ("Tx+Ax", "Ty+Ay") of the direction of X, and the direction of Y equal to the pitch ("Spx", "Spy") of the optoelectric transducer corresponding to each direction. That is, the effect shows up to X and Y both directions by considering as "Spx"="Tx+Ax""Spy"= "Ty+Ay", arranging the quantity of light in respect of sensor light-receiving so that it may become the maximum as a spatial phase relation is shown in drawing 14 , and giving it similarly to two-dimensional.

[0084] Furthermore, "Spx" ="Tx+Ax" *Nx (Nx : positive integer)
"Spy" ="Ty+Ay" *Ny (Ny : positive integer)
the effect is the same even if it extends -- obvious -- it is .

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The whole X-ray image pck-up equipment block diagram showing the 1st example of this invention
[Drawing 2] The cross section of a grid (when X line source is comparatively far)
[Drawing 3] The cross section of a grid (when X line source is comparatively near)
[Drawing 4] The plan of the photoelectrical inverter portion in X-ray image pck-up equipment (4 bits)
[Drawing 5] The cross section of the photoelectrical inverter portion in X-ray image pck-up equipment (A-B cross section in drawing 4)
[Drawing 6] The band view showing device operation of an optoelectric transducer
(a) Refreshment mode
(b) Photoelectrical translation mode
(c) The saturation state in a photoelectrical translation mode
[Drawing 7] The representative circuit schematic of the photoelectrical transducer in the X-ray image pck-up equipment of this invention (1 pixel)
[Drawing 8] The timing chart which shows operation of the equal circuit of drawing 7
[Drawing 9] The representative circuit schematic of the photoelectrical transducer in the X-ray image pck-up equipment of this invention (9 pixels)
[Drawing 10] The timing chart which shows operation of the equal circuit of drawing 9
[Drawing 11] The mounting conceptual diagram of the X-ray detector which has 2000*2000 pixels
[Drawing 12] the mounting conceptual diagram (others -- an example) of the X-ray detector which has 2000*2000 pixels
[Drawing 13] The cross section of the X-ray image pck-up equipment in which the 2nd example of this invention is shown (in the case of "S"= "T+A")
[Drawing 14] The cross section of the X-ray image pck-up equipment in which the 3rd operation gestalt of this invention is shown
[Drawing 15] The cross section of the X-ray image pck-up equipment in which the 3rd operation gestalt of this invention is shown
[Drawing 16] The cross section of the X-ray image pck-up equipment in which the 2nd example of this invention is shown (in the case of "S" ="T+A" * double precision)
[Drawing 17] The rough perspective diagram of the X-ray image pck-up equipment in which the 2nd example of this invention is shown
[Drawing 18] The whole block diagram showing the conventional example of X-ray image pck-up equipment (film method)
[Description of Notations]
200 X-ray Absorption Matter (for example, Lead)
201 Radioparency Matter (for example, Aluminum)
400 Insulating Substrate
401 Optoelectric Transducer
402 Switching Element
403 Protective Coat
421 1st Metal Thin Film Layer
422 2nd Metal Thin Film Layer
425 a-SiNx
426 a-Si:H
427 N+ Layer
408 Gate Control Line of Switching Element 402
409 Signal Line from Switching Element 402
410 Bias Line Which Gives Bias to Optoelectric Transducer 401
405 Light-receiving Side of Optoelectric Transducer 401
420 Contact Hole
430 Cross Section of 1st Metal Thin Film Layer 421 and 2nd Metal Thin Film Layer 422

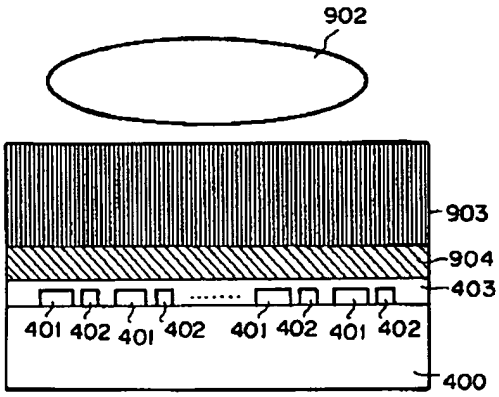
602 Lower Electrode of Optoelectric Transducer in Band View (G)
606 Up Electrode of Optoelectric Transducer in Band View (D)
604 I Layers of Optoelectric Transducer in Band View (A-Si:H)
605 N Layers of Optoelectric Transducer in Band View
607 Insulating Layer of Optoelectric Transducer in Band View (A-SiNx)
701 Bias Power Supply (Vr)
730 Gate Terminal of TFT402
705,722 Switching device for reset
707 Power Supply for Reset (VBT)
713 Capacitative Element
720 Capacity in Processing Circuit (IC)
725 Switching Element in Processing Circuit
724 Operational Amplifier
901 X Line Source
902 Human Body (Patient)
903 Grid
904 Scintillator (X-ray-Visible Conversion Fluorescent Substance)
S11-S33 Optoelectric transducer
T11-T33 Switching element
Vs Read-out power supply
Vr Refreshment power supply
SWs Vs power supply changeover switch
SWr Vr power supply changeover switch
RF Refreshment control circuit
g1-g2000 Control wiring of TET
sig1-sig2000 Signal wiring

[Translation done.]

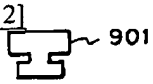
* NOTICES *

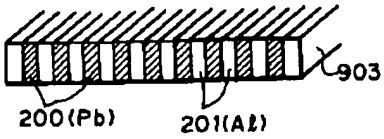
DRAWINGS

[Drawing 1]

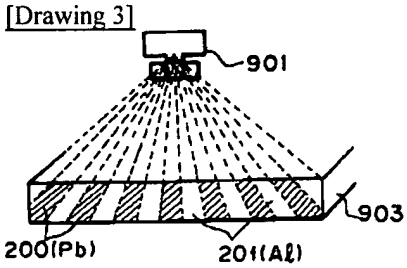


[Drawing 2]

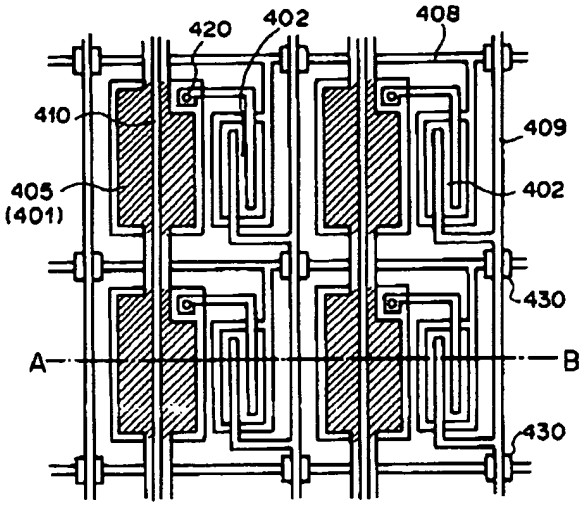




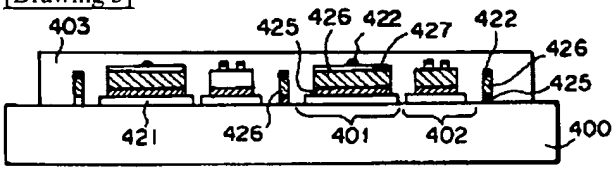
[Drawing 3]



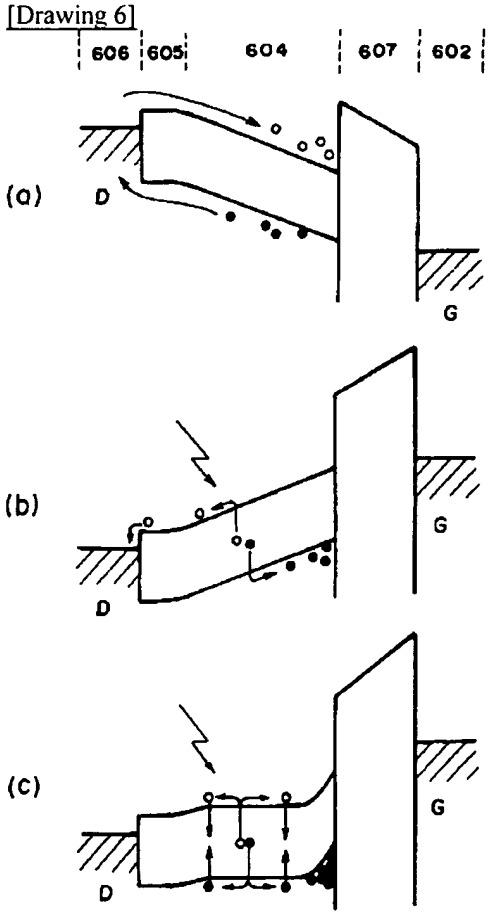
[Drawing 4]



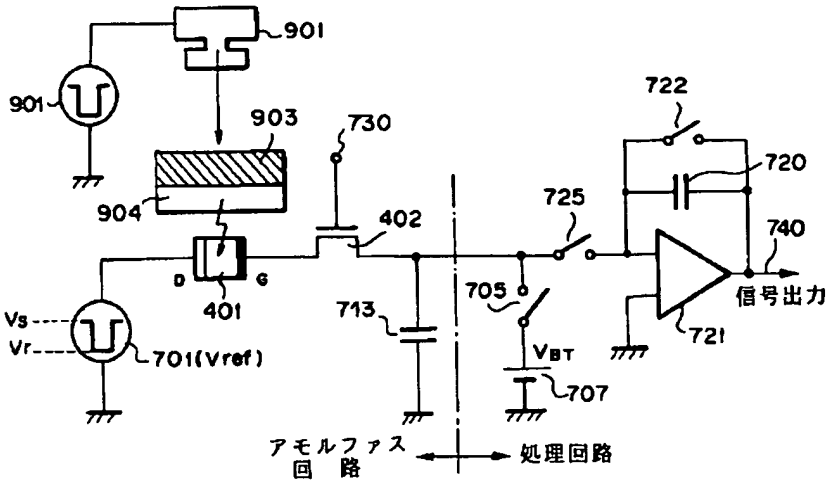
[Drawing 5]



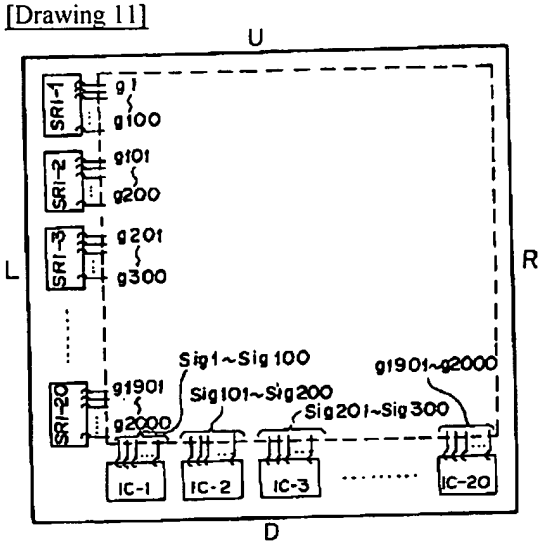
[Drawing 6]



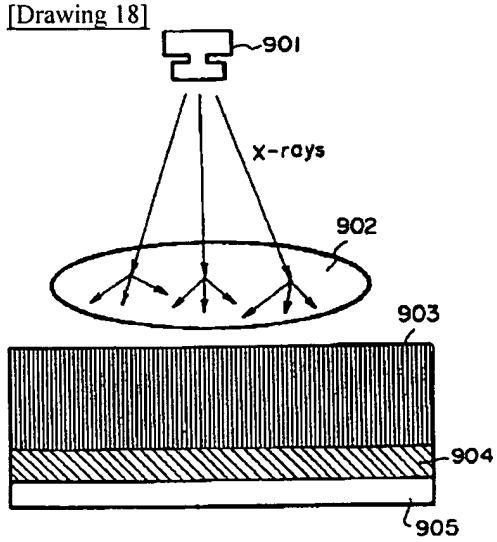
[Drawing 7]



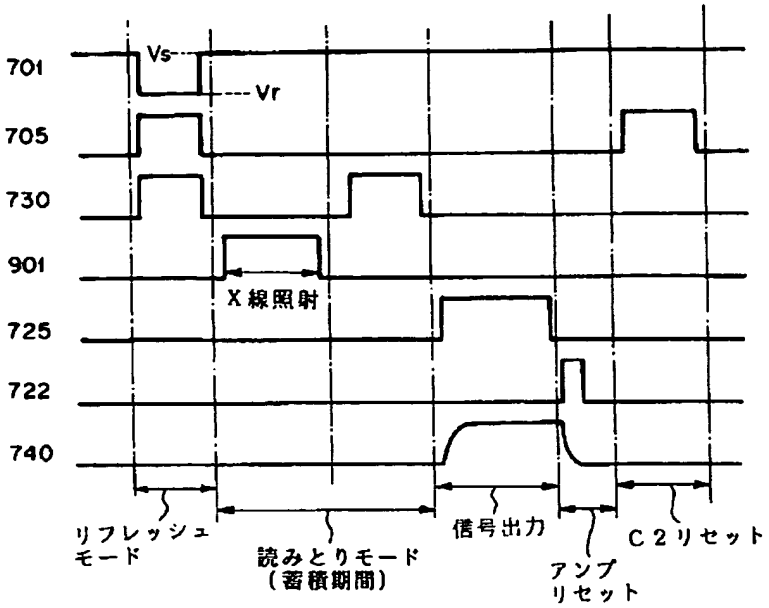
[Drawing 11]



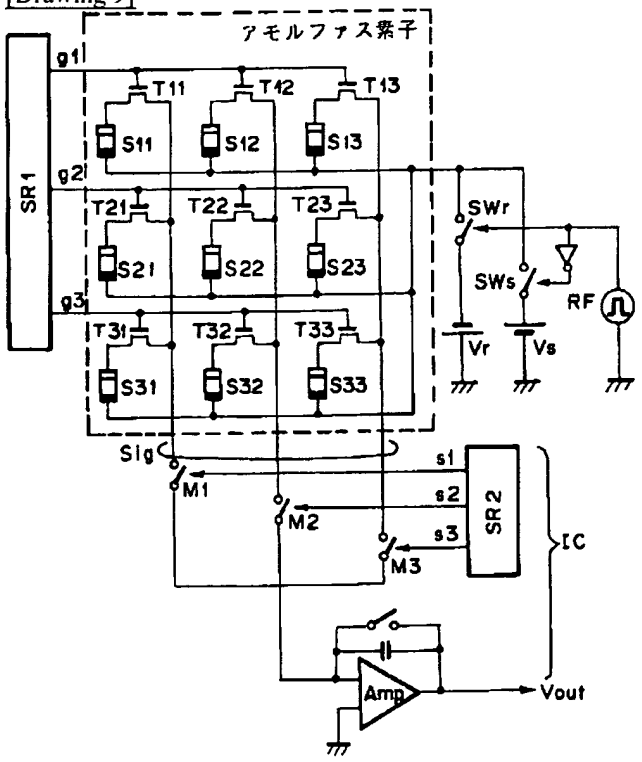
[Drawing 18]



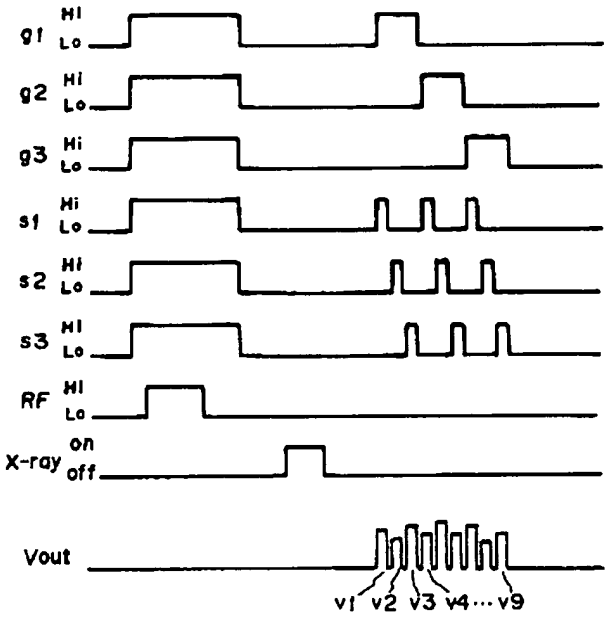
[Drawing 8]



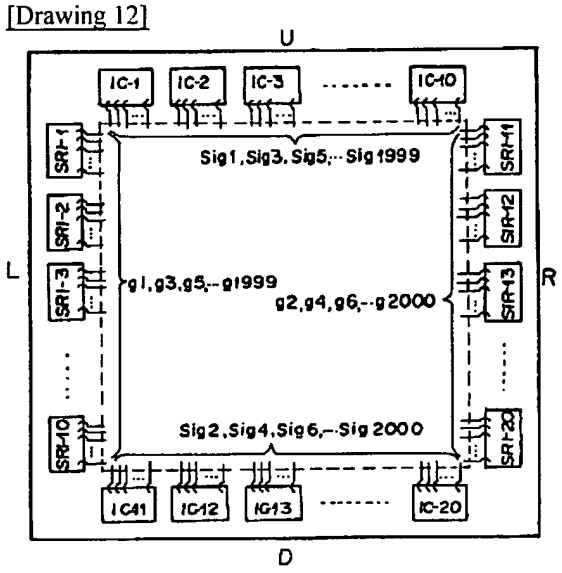
[Drawing 9]



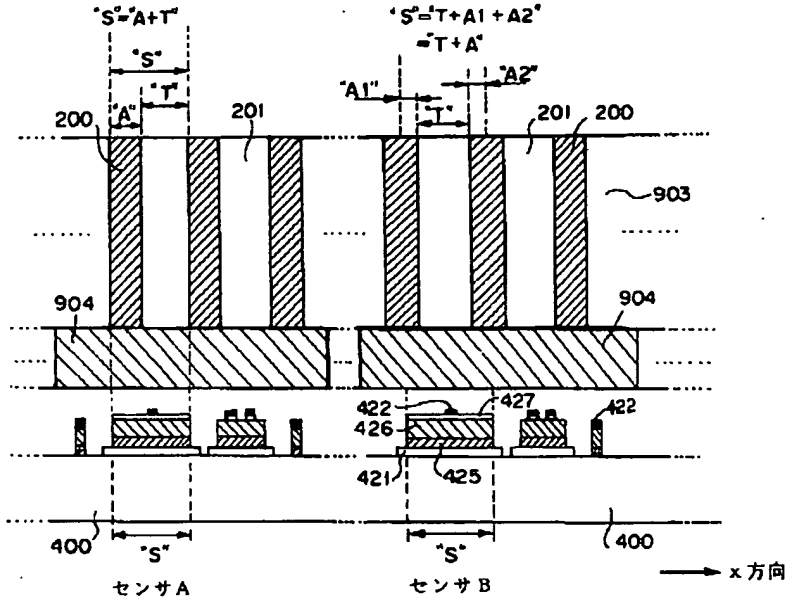
[Drawing 10]



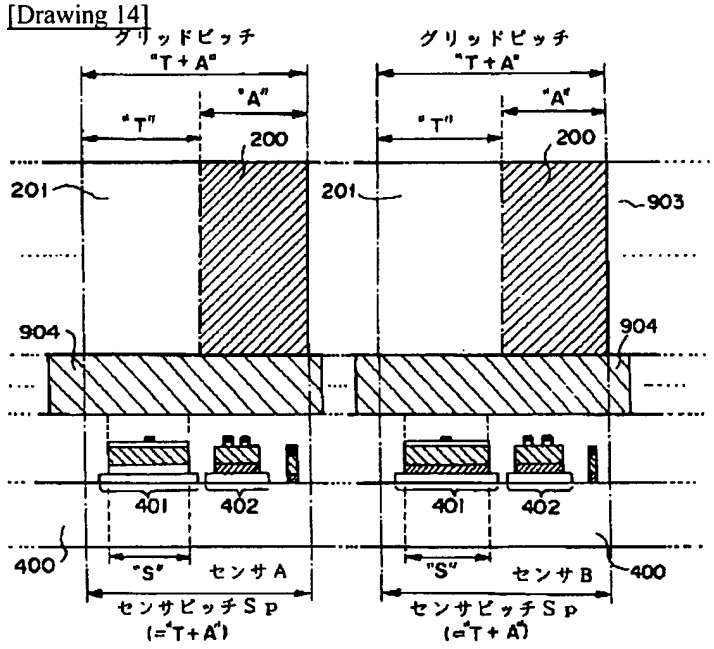
[Drawing 12]



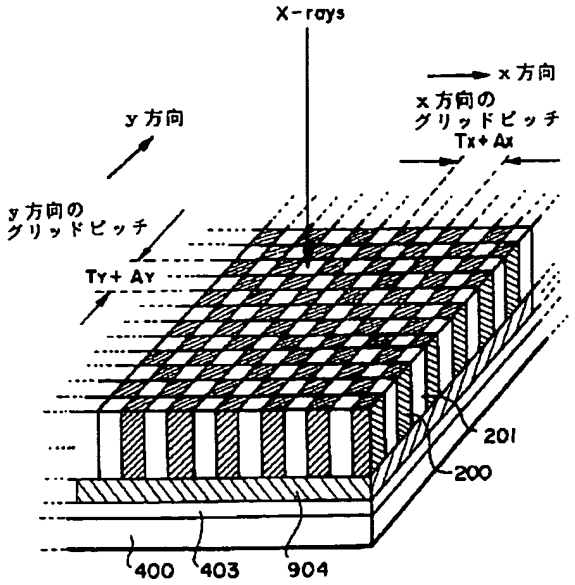
[Drawing 13]



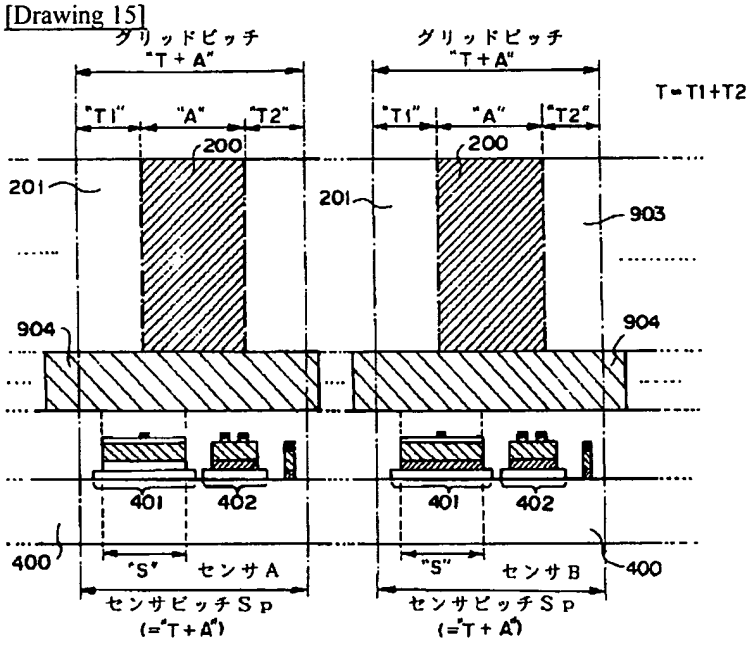
[Drawing 14]



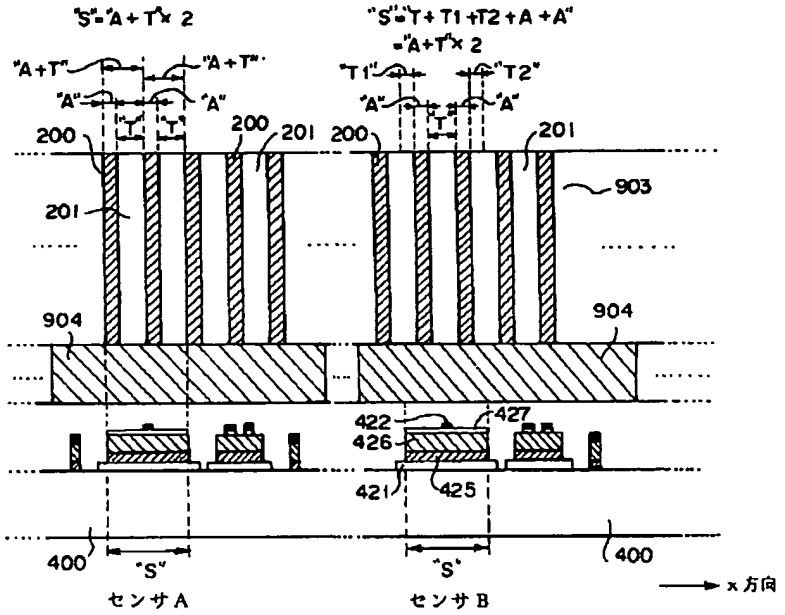
[Drawing 17]



[Drawing 15]



[Drawing 16]



[Translation done.]

CORRECTION or AMENDMENT

[Official Gazette Type] Printing of the amendment by the convention of 2 of Article 17 of patent law.
[Section partition] The 2nd partition of the 1st section.
[Date of issue] December 11, Heisei 13 (2001. 12.11)

[Publication No.] JP,9-98970,A.
[Date of Publication] April 15, Heisei 9 (1997. 4.15)
[**** format] Open patent official report 9-990.
[Filing Number] Japanese Patent Application No. 7-259625.
[The 7th edition of International Patent Classification]

A61B	6/06	331	.
G01T	1/20		.
G21K	4/00		.
5/02		.	

[FI]

A61B	6/06	331	.
G01T	1/20	E	.
G21K	4/00	A	.
5/02	X	.	

[Procedure revision]
[Filing Date] June 27, Heisei 13 (2001. 6.27)
[Procedure amendment 1]
[Document to be Amended] Specification.
[Item(s) to be Amended] Claim 1.
[Method of Amendment] Change.
[Proposed Amendment]
[Claim 1] The two-dimensional picture reader which formed two or more optoelectric transducers in the shape of two-dimensional on the insulating substrate,
The fluorescent substance which was formed by sticking substantially on the aforementioned two-dimensional picture reader and which changes an X-ray into the light,
X-ray image pck-up equipment characterized by having the grid board which was formed between the aforementioned fluorescent substance and X line source, and which derives the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, and being constituted.
[Procedure amendment 2]
[Document to be Amended] Specification.
[Item(s) to be Amended] 0020.
[Method of Amendment] Change.
[Proposed Amendment]
[0020] [1] The two-dimensional picture reader which formed two or more optoelectric transducers in the shape of two-dimensional on the insulating substrate,
The fluorescent substance which was formed by sticking substantially on the aforementioned two-dimensional picture reader and which changes an X-ray into the light,
X-ray image pck-up equipment characterized by having the grid board which was formed between the aforementioned fluorescent substance and X line source, and which derives the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, and being constituted.

[Procedure amendment 3]
[Document to be Amended] Specification.
[Item(s) to be Amended] 0025.
[Method of Amendment] Change.
[Proposed Amendment]
[0025]
[Embodiments of the Invention] The X-ray image pck-up equipment concerning a [operation] this invention is a two-dimensional picture reader which made two or more optoelectric transducers form in the shape of two-dimensional on an insulating substrate. By constituting from a grid board formed between the fluorescent substance which changes into the light the X-ray stuck on the aforementioned two-dimensional picture reader, and the aforementioned fluorescent substance and X line source in order to derive the X-ray from specification to the aforementioned fluorescent substance and the aforementioned two-dimensional picture reader, without using a film, an X-ray picture can be obtained and data processing also becomes easy.

[Translation done.]